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Idaho Recommendations for Insect Control

By
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and
R. A. FISHER

COOPERATIVE EXTENSION SERVICE IN AGRICULTURE AND HOME ECONOMICS OF THE STATE OF IDAHO UNIVERSITY OF IDAHO EXTENSION DIVISION AND UNITED STATES DEPARTMENT OF AGRICULTURE COOPERATING

ENTOMOLOGY SECTION

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How to Use This Bulletin

THE insects discussed in this bulletin are only those of economic importance which are known to occur in Idaho. The insects are arranged alphabetically according to the accepted common names of the pests. If you know the name of the insect for which you desire further information, it can be readily found alphabetically.

An index has been included beginning on page 71. It is arranged alphabetically according to the host of the insect. If you have insects, for instance, which you do not know, occurring on a crop or animal, you may turn to the index to find the common name of the insects which attack that crop or animal. By reading the brief description of the insect or its injury, you should be able to determine the insect in question and thus find its control. Obviously it has not been possible to include a complete description of either the insect, its damage or its control because of the large number of insects involved. Further information concerning any pest may be obtained by writing to the Entomologist, Idaho Agricultural Experiment Station, Moscow, Idaho.

You may wish to study other literature on any pest herein mentioned. It is then necessary to be certain that you have information concerning the species involved. A list of the accepted common and scientific names is included to make identification more certain. This list will be found on page —.

A discussion of the usual methods of preparation of insecticides is included in the latter part of the bulletin on page 62. When methods of control are mentioned, you may turn to this section for more complete directions for preparing the materials.

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By

W. E. SHULL and R. A. FISHER*

Alfalfa Caterpillar. The adult of this caterpillar is a butterfly with the undersides of the wings colored a solid sulphur yellow. The upper sides of the wings are yellow bordered with black. The larvae, when young, are dark brown and then change to green. A narrow white stripe, through which runs a fine red line, occurs on each side of the body of the caterpillar. The larvae feed upon the foliage of alfalfa.

Control: Spray or dust as recommended for alfalfa weevil, or cut the alfalfa as short as possible and remove the hay.

Alfalfa Looper. The color of the larvae varies from cream to yellowish-green and dark green. Fully grown larvae are about 1 inch long and crawl in a looping fashion. They feed on various weeds and crop plants, including alfalfa, rarely becoming numerous enough to cause serious injury.

Control: Infestations of importance usually develop on the first crop of alfalfa a short time before the date for cutting. The most practicable means of control is to cut the first crop as soon as damage is becoming severe. Cure and remove the hay from the field as soon as possible.

Alfalfa Weevil. The adult is a dark brown beetle 3/16 inch long, with a moderately long snout which points downward from the underside of the head. Fully grown larvae are about ¼ inch long. The color of the larva varies from dingy yellow, when very young, to light green when mature. Larvae are readily recognized by a faint white stripe down the middle of the back and by a black head. They destroy the tips of first crop of alfalfa or, when infestations are heavy, defoliate the plants as well as retard the growth of the second crop.

Control: When injury is severe, the first crop of alfalfa should be sprayed with calcium arsenate in water at the rate of 2 pounds per acre. The spraying should be done as soon as the tips of the plants have a generally ragged, eaten appearance. Spraying on the first crop prevents further damage to both first and second crops. When the infestation is light, cut the first crop for hay when the injury begins to be generally noticeable.

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* Entomologist and Assistant Entomologist, respectively, of the Idaho Agricultural Experiment Station and the Idaho Agricultural Extension Service.

Angoumois Grain Moth. The moth varies in color from buff to grayish- or yellowish-brown. It is about 5/16 inch long. Eggs are laid on or near grain. Larvae are white with yellowish-brown heads, and are about 1/5 inch long when mature. Injury in Idaho is confined to grain in storage. Larvae hollow out the interiors of kernels and pupation takes place inside the kernels. Kernels from which moths have emerged are identified by the circular emergence holes.

Control: Follow the recommendations for saw-toothed grain beetle. Fumigation by the use of hydrocyanic acid gas is recommended for eradicating the insects in buildings. Write to the Idaho Agricultural Experiment Station for special instructions.

Ants. Many species of ants are troublesome in houses, lawns, gardens, fruit trees, etc. Before attempting control, it is necessary to locate their nests, if possible. Ants in fruit trees are usually attracted by aphids, upon whose sweet secretions they feed. They also kill or drive off the natural enemies of the aphids.

Control: When nests are located, the ant colonies are often completely eradicated by making from one to three or four holes (depending on the size of the mound) in the mound, about 12 inches deep and pouring into each hole 1 ounce of granular calcium cyanide or 2 ounces of carbon disulphide and then covering the hole with earth. These materials kill vegetation and cannot be used in close proximity to growing plants. When it is desirable to kill colonies among growing plants, concentrated pyrethrum extract, diluted 1 to 1000 parts of soapy water, should be used to wet the interior of the nests. Scrape away the top of the nest saucer-like, and pour the liquid into the center so that it will penetrate to the bottom of the nest. In lawns or in tree rows in orchards where definite colonies cannot be located, ant infestations are gradually wiped out by persistent use of granular calcium cyanide scattered lightly over the soil during the warm part of the day when ants are active. Household ants usually have definite nests outside the house, and when their nests can be located should be treated as already described. When nests are not found, excellent control has resulted by scattering freely in the areas frequented by the ants a mixture composed of 75 parts of sodium fluoride, 15 parts of granulated sugar, and 10 parts of fresh pyrethrum dust. This mixture is relatively non-poisonous to humans and may be kept sprinkled lightly on pantry shelves, beneath bins, etc. A carbon-disulphide naphthalene emulsion is also very effective. The formula for this material may be obtained from the Idaho Agricultural Experiment Station. A proprietary preparation recently placed on the market under the trade name of "Apex Ant Killer" has proved very satisfactory.

Apple Aphid. This green plant louse feeds on the water sprouts and on tender terminal leaves, curling them badly. The black, shiny

eggs are laid on the bark of the smaller branches in the autumn and hatch the following spring just before the bud scales separate. There are many generations in a season.

Control: Spray with 1 pint of nicotine sulphate and 1 gallon of dormant-type oil emulsion in 99 gallons of water when the green tips of the buds are separating, or add 1 pint of 40 per cent nicotine sulphate to each 100 gallons of dormant oil emulsion or lime-sulphur spray used for San Jose scale control if the spray is applied at the time above indicated. When control is not obtained in the early spring, it is practicable to add ¾ pint of 40 per cent nicotine sulphate and 1 gallon of summer-type oil emulsion to each 100 gallons of spray at the time of the first or second cover sprays for codling moth. Poor control is to be expected if nicotine sulphate is used when temperatures drop below 70°F.

Apple Leafhoppers. Severe injury is caused to the foliage of apple trees by the feeding of both the young and the adult forms of two species of leafhoppers. The green-colored species has but one generation each year while the white-colored species has two. Both species occur in the early spring in the nymphal stage and the injury from each is similar. Injured leaves lose their green color, become dry, and are covered with tiny, light-colored flecks. The injury results from the insect sucking the sap out of the leaf tissue.

Control: Control is the same for both species. It is not difficult to obtain good control, but spraying must be done when nymphs of the green leafhopper and nymphs of the first generation of the white species are present on the foliage. This is about the time of the first or second codling moth cover sprays. At that time they are readily controlled by the use of summer-type oil emulsion at the rate of 1 gallon in 100 gallons of spray solution. Attention must be directed to covering the under surfaces of the leaves. After the insects become winged, they are difficult to kill and it is necessary to add pyrethrum extract or 40 per cent nicotine sulphate at the rate of 1 pint to 100 gallons of the oil emulsion spray. When oil is used in the first two cover sprays for codling moth control, it usually controls leafhoppers.

Asparagus Beetle. The adult is a slender beetle about ¼ inch long, blue-black in general color with red on the thorax and dark blue wings marked with lemon-yellow and reddish borders. The larvae are dark to olive-gray with black head and legs. The eggs are arranged in rows of from 6 to 8 scattered over the foliage. They are brownish in color and measure 1/16 inch in length. The larvae and adults feed on the leaves of the asparagus plants and the adults feed on the tender young shoots in the spring.

Control: Hand picking is of considerable value in home gardens. The young larvae may be killed by brushing them to the ground

in hot weather. Spray late in the season with 2 pounds of arsenate of lead in 50 gallons of water or dust with calcium arsenate 1 pound and hydrated lime 3 pounds. Arsenicals can be applied only when cuttings are not being made. During the cutting season apply a dust containing 1 per cent rotenone.

Bark Beetles. These stout, cylindrical, brownish to blackish beetles are 1/8 to 3/16 inch long. The larvae are grub-like, white to cream in color, and are found beneath the bark of coniferous trees. The adults bore small holes in the bark, and tunnel through the cambium layer. Their presence in the trees is characterized by the boring dust at the bases and pitch tubes on the trunks of the trees. The green foliage of attacked trees turns first to a pale green, then to light yellow, and finally to brown, when the trees are dead. They attack mostly mature coniferous trees.

Control: No control is known which will save trees that have been attacked. Unattacked trees may be protected by felling the infested trees before the insects have reached maturity, removing and burning the bark and slash, and allowing the trunks of the trees to dry.

Bedbugs. Bedbugs are widely distributed in Idaho. Their wingless bodies are ovate and very flat and reddish brown in color. Ordinarily they are found only in dwellings of man but have been known to infest chicken houses.

Control: The only completely satisfactory method of eradicating bedbugs quickly is by fumigation. Special precautions must be followed. Those interested should write to the Idaho Agricultural Experiment Station for special instructions. In cases where it is impracticable or not desirable to fumigate, relief is obtained and sometimes infestations even eradicated by persistent "doping." Spray liberally all cracks and crevices in walls, woodwork, bedstead, etc., with gasoline, or kerosene-pyrethrum (made by mixing 1 part of concentrated pyrethrum-oil extract with 19 parts of kerosene). Remove all loose or torn wallpaper. Wherever possible, fill up cracks in walls, floors, cupboards, etc., with crack filler or putty, and complete the work with a coat of paint or varnish. A mixture of corrosive sublimate 1 ounce, alcohol 1 pint, and turpentine ¼ pint painted into cracks in bedsteads, walls, etc., is effective in local applications when used repeatedly.

Beet Leafhopper. This sucking insect is only about ⅛ inch long when fully grown, and in the spring is pale or yellowish green in color. It feeds on sugar beets and related plants, on tomato, squash, beans, spinach, and many other plants. It winters in the adult stage. The insect breeds on mustards, Russian thistle, and other plants in desert areas, abandoned dry farms, and waste places from whence the adults migrate to beet fields during the spring

and early summer. It transmits a disease known as curly-top. The size of the population and the severity of the disease vary from year to year, the variation depending to a large extent on climatic and native host plant conditions.

Control: No practical methods of controlling the insect are known. The use of curly-top resistant strains of beets recommended by the U. S. Department of Agriculture is advisable. Resistant strains of beans are also available.

Beet Webworm. The moth is slightly more than ½ inch in length and when at rest, with the wings folded over the body, is triangular in outline. The moth is delicate gray or brown. When disturbed it takes wing, making jerky, zigzag flights. Eggs are pearly white or yellowish, flat, about the size of a small pinhead and are laid on the under leaf surfaces in rows, often with the eggs overlapping. Larvae vary from light green to dark green and have a characteristic darker line down the middle of the back with a row of dark circles on either side. When fully grown they are about ¾ inch long. There are two generations annually. They winter in the pupal stage in the soil and the moths appear in the latter part of May or early June. Larvae are most abundant from the last of June to about the middle of July. When abundant, they completely defoliate sugar beets and other related plants, as well as alfalfa and many other cultivated plants.

Control: Webworms breed on many kinds of weeds, especially lamb's-quarter and Russian thistle. These weeds should not be allowed to grow near or in fields where beets are planted. Beets should be inspected often and sprayed or dusted as soon as eggs or tiny larvae are found on the under surfaces of the leaves in June. Spray infested fields thoroughly with lead arsenate or calcium arsenate in water, at the rate of 8 pounds per acre. To the spray add a spreader at the rate of ½ pound to each 100 gallons of liquid. The spreader greatly increases the adherence of the liquid to the beet foliage. Paris green may be used at the rate of 4 pounds per acre. A practical means of control is to use hand or power dusters and apply calcium arsenate dust, diluted with 3 pounds of hydrated lime or diatomaceous earth to 1 pound of poison, at the rate of from 15 to 20 pounds of the mixture per acre. Dusting has the advantage of using cheap, simple equipment. Calcium arsenate is low in cost and hand dusters can be put into operation very quickly. *It is imperative that control be obtained early before damage to beets occurs.*

Birch-Leaf Skeletonizer. This insect attacks most of the species of birches and alder. The moth is a tiny one with a wing expanse of about ⅜ inch, bright brown in color and the fore wings crossed with three diagonal silvery bars. The head is white. The larvae are about ¼ inch long, slender and green in color. The larvae feed on the lower surface of the leaves.

Control: It is attacked by many species of parasites and therefore control is seldom necessary, but lead arsenate may be applied at the rate of 4 pounds in 100 gallons of water when injury becomes apparent.

Black Cherry Aphid. This large, shiny, black plant louse curls terminal foliage of cherry trees and excretes a sticky honey-dew on leaves and fruit. It winters in the egg stage on the trees. Eggs hatch about the time buds burst in the spring. There are several generations annually on cherry trees.

Control: Spray with 40 per cent nicotine sulphate, ¾ pint, and dormant-type oil emulsion, 1 gallon to 99 gallons of water, just as the buds are breaking, or add the nicotine sulphate to the dormant oil or lime-sulphur sprays.

Black Flies. Black flies, or punkies as they are often called, are sometimes severe pests of horses and mules. These insects breed in streams and spend the entire larval period in swiftly running water. The adults emerge from the water in large numbers to attack animals.

Control: No control is known.

Black Peach Aphid. This plant louse winters on the roots and migrates to the twigs about the time buds are swelling. Adults are shiny black; young are reddish brown.

Control: Spray with 40 per cent nicotine sulphate as for "apple aphid" as soon as the insect is observed on the tips of the twigs or on foliage.

Black Vine Weevil. This snout beetle is about 5/16 inch long, and brownish black in color. The white legless larvae are about 3/8 inch long. They live in the soil and feed on the roots of strawberry and many other plants.

Control: The same control measure as recommended for the strawberry root weevil is effective, but the bait should be applied just after the date when berries from annual varieties are all harvested.

Black Widow Spider. The black widow spider is more poisonous than any other spider found in the United States. Painful and serious systemic disturbances may result from its bite but very few cases of death due to the attack of the spider have been recorded. The female black widow spider is entirely black and shining on the upper surface of the body. On her under side she usually has one or more red spots near the posterior tip of the abdomen and an hour-glass-shaped red or orange mark on the lower central part of the abdomen. The immature spiders and adult males usually

have yellowish markings on the upper side of the abdomen. The males are smaller than the females.

Control: The black widow spider is widely distributed in nature and, therefore, its eradication is impossible. The removal of materials which harbor the spiders is recommended. Spray the places where the spiders are found with undiluted creosote oil. This material kills the spiders which it strikes and repels others. The spiders and their eggs may be crushed and thus eliminate a mild infestation.

Blister Beetles. Three species are sometimes injurious to cultivated crops, especially near the margins of fields. The spotted blister beetle is the most common. It is from ½ to ¾ inch long, of general gray appearance with small black spots. The ash-gray blister beetle, somewhat smaller than the spotted blister beetle, is uniformly gray in color. Nuttal's blister beetle is green or purplish blue, varying from about ⅝ inch to 1⅛ inches long. Larvae live in the ground, some of them feeding on grasshopper egg masses, and infestations usually occur in areas where grasshoppers have been numerous.

Control: Control is not often necessary but occasionally it pays to prevent injury, especially around the edges of sugar beet, alfalfa, and potato fields. Dust the infested plants and the beetles thoroughly with a mixture of equal parts of sodium fluosilicate and hydrated lime, or with undiluted calcium fluosilicate. A dust containing 1 per cent of rotenone is also effective.

Boxelder Bug. This insect is about ½ inch in length, black in color with red markings. It sucks the sap from boxelder trees. When this bug is abundant, it frequently becomes a nuisance in dwellings.

Control: When bugs collect in numbers on buildings or on trees, they may be killed by spraying with pyrethrum extract or 40 per cent nicotine sulphate, 1 pint to 100 gallons of soapy water.

Bronze Birch Borer. The bronze birch borer is a flatheaded borer which is often a serious pest of birches, especially white or paper birch. The first symptoms of attack is a browning of the tips of the upper branches, followed by the death of the entire tree. The larvae are about ½ inch long, white and very slender with a slight enlargement near the anterior end and with two brownish projections near the posterior end. The adults are greenish-bronze beetles with rather blunt heads and slender pointed bodies. The larvae bore in the inner bark and the sapwood of the host.

Control: Cut out and burn during the winter all infested parts of the tree.

Brown Mite. The brown mite or clover mite is commonly found on prune and sometimes does serious injury. This species is distinguished from the European red mite by its rusty brown color, larger size, and flattened back. The two front legs are much longer than the others and extend straight out in front. The winter is passed in the egg stage and the summer eggs are laid on the leaves. The eggs are bright red, spherical, and smooth, although when highly magnified appear to be lightly dusted with a fine granular substance. They cannot be distinguished from the red mite egg with the naked eye. On hatching in the spring, the mites attack the developing fruit buds and when infestations are heavy, will so injure the buds and blossoms that much fruit fails to set. The foliage may be injured during the spring and early summer but usually not later since the mites decrease rapidly in numbers with the arrival of high temperatures.

Control: They are controlled by using dormant type oil spray as for the red mite to kill the over-wintering eggs. Summer sprays should not be depended upon for control since they would be applied after the most serious injury had been done.

Bulb Mite. This white, 8-legged creature is about 1/32 inch long. It is usually found in colonies on roots or bulbs or in decaying vegetable matter, always away from the light. It injures many kinds of bulbs and breeds continuously in greenhouses or wherever moisture and temperature are high.

Control: Plant bulbs on ground that has been kept well aerated and cultivated and free from decaying vegetable matter. Burn all soft or decayed bulbs. Store bulbs at a temperature of about 35° F. Before planting immerse all infested bulbs for 10 minutes in 40 per cent nicotine sulphate, 2½ teaspoonfuls to 1 gallon of water at a temperature of 110° F., or in a 2 per cent formalin solution for the same time and at the same temperature.

Cabbage Aphid. These dark green or bluish plant lice, covered with a powdery secretion, sometimes become exceedingly abundant on the under sides of leaves of individual cabbage plants. From these they later spread to other plants in the field.

Control: Pull and destroy individual infested plants as soon as they are observed in the spring, or dust or spray them with nicotine sulphate. When fields are generally infested, dust or spray the entire area as soon as the aphids are observed. Use 2 per cent nicotine dust prepared as described on page 66, or a spray solution composed of ¼ pint of 40 per cent nicotine sulphate or ¼ pint of pyrethrum extract and 25 gallons of water to which has first been added 1 pound of laundry soap or 1 quart of summer-type oil emulsion. Plants should be very thoroughly dusted or sprayed and kept free from the aphids until after the heads

have well formed. Late season spraying is usually unsatisfactory and is unnecessary if early control is maintained.

Cabbage Maggot. Adults are gray flies resembling the house fly but are smaller. The flies deposit their eggs on the soil near the stems of the plants, and the maggots hatching from them infest the stems of cabbage and cauliflower and the fleshy roots of radish and turnip. Maggots are cream colored.

Control: Dissolve 1 ounce of corrosive sublimate in 10 gallons of hot water and pour ½ cup of the solution on the ground immediately around each plant or along the row in case of radishes. Make the first application 5 days after setting out cabbage plants and repeat two or three times at 10-day intervals.

Cabbage Worm (Imported). The cabbage butterfly is white and is frequently observed flying about cabbage plants. The yellow eggs are placed singly and on end on the under sides of cabbage leaves, nasturtium leaves, etc. The cabbage worm is light green and velvety in appearance, and when mature is about ¾ inch long.

Control: Make a heavy application of rotenone dust when the worms appear. Control should be begun as soon as larvae are first noticed and continued until after heads have begun to form well. Paris green, 1 part, mixed with flour, 25 parts, may be used as a dust until the heads begin to form.

Carpenter Worm. These pinkish or white larvae with brown heads sometimes completely kill trees. Mature larvae are about 2½ inches long. The large dark gray moths deposit their eggs in the early summer in cracks or crevices of bark or near wounds or the openings of old burrows. The young larvae, as soon as they hatch, begin boring into the trees and feed and grow inside the wood for nearly three years. Injury is especially severe in the region of the main crotch on the trunks of cork elm trees.

Control: Cutting and burning trees in the winter kills the larvae and prevents the escape of moths to infest other trees. Larvae often may be dug out of the trunk by means of a sharp chisel and the wound then disinfected. Sometimes it is practicable to clean out the burrow as well as possible, force into it a small amount of calcium cyanide-linseed oil mixture, and plug the entrance with mud or putty. The mixture is made by stirring fine granular calcium cyanide into linseed oil until it has the consistency of thick paint. Another method is to inject carbon disulphide into the burrows by means of a small oil can.

Carpet Beetles. Woolen goods, carpets, furs, etc., and occasionally food materials are eaten by larvae of the carpet beetles. These larvae are dark brown and very hairy. They are about ¼ inch

long when mature and very sluggish in movement. The adults are small, blackish, hard-shelled beetles.

Control: See directions for control of the larder beetle.

Cattle Biting Lice. Cattle biting lice do not feed on the blood but rather on the scales of the skin. They cause the hair to become rough and spots may be entirely removed by rubbing the affected parts. These lice are found on the upper parts of the body in contrast to the position in which the sucking lice are found.

Control: The control is the same as for the short-nosed cattle louse.

Cattle Grubs. Cattle grubs are the larvae of two different flies, one known as the common cattle grub and the other as the northern cattle grub. They are first noticed in the cattle when tumors as big as the end of the thumb appear on the backs of the animals during late winter or early spring. They are commonly known as cattle grubs in this stage. The tumors contain the larvae of the fly which has passed through the body of the cow to reach the back, and have therefore done their damage before they are noticed. The hairy flies, which are about as large as honeybees, chase the cows in the pasture while the insects deposit their eggs on the hair of the lower extremities. The tiny larvae which hatch from those eggs burrow into the skin of the cow and migrate through the body to the back where the grubs form a tumor.

Control: Cattle grubs can be attacked best when they are in the back of the cattle. This serves to reduce the population of flies which would produce grubs in the back the following year. The job must be done thoroughly and all stock over an entire area must be treated in the winter. The grubs may be squeezed out of the tumors when the hole in the skin has appeared and then crushed, or they may be taken out with tweezers or chemicals may be rubbed into the cyst. The most successful method is the application of a wash made of derris as follows: 1 pound of derris root containing 1 per cent rotenone, ¼ pound of soft soap, and 1 gallon of water. The soft soap is boiled in a quart of water and when cool is poured into the derris powder and mixed into a paste. Cold water is added slowly while stirring to make up a gallon. This mixture should be applied liberally to the backs of the animals with a soft cloth or a worn grooming brush, care being taken to cover completely the area affected by the grubs. Four or five applications should be made at intervals of about 28 days. Ointments of derris, pyrethrum or iodoform with vaseline and sweet oil as a base may be applied to the openings of the cysts with good results.

Centipedes. These tiny centipedes feed on the tender roots of greenhouse plants and when numerous eat off the new growth

as fast as it is formed. They also eat into the stems near the ground and into the roots, causing small wart-like growths and allowing the entrance of disease organisms.

Control: Control is extremely difficult. Greatest care should be exercised to prevent introduction of the creatures in soil from out of doors or to prevent bringing them in with shipments of plants. The only method yet known of freeing soil of an infestation is by sterilization with steam or heat.

Cherry Fruit Fly. Flies are small, brownish, and are distinguished by having dark bands at intervals across their wings. They emerge from the ground in June or July and fly about in the sun for a few days before beginning to lay eggs. Eggs are inserted through the skin into the flesh of the cherries. Larvae develop to maturity inside the cherries. The maggots are white and when mature are about ¼ inch long.

Control: Allowing no cherries to remain on the trees after picking time prevents the escape of any maggots to reinfest the next year's crop, for maggots do not mature until after the date cherries should be harvested. A poisoned bait spray kills the adults which feed on it freely during the time elapsing after emergence from the ground and before they begin to lay eggs. To make the bait, add 2 quarts of molasses or syrup and ½ pound of lead arsenate to 10 gallons of water. The proper time to use the bait first is just before Royal Ann cherries begin to show the first pink coloring. One or two later sprays may be needed at about 7-day intervals. The spray is applied at low pressure and in coarse drops to the outer foliage of the cherry trees and to the foliage of nearby trees or bushes. From 1 to 2 pints of the bait per tree is sufficient.

Chicken Lice. There are several species of lice attacking chickens. All but head lice may be controlled in the same manner.

Control: Use nicotine sulphate, applied on perches either by painting or by a fine line poured from the can, just before roosting time. Repeat in 2 weeks to kill the newly hatched lice. Head lice may be controlled on chickens and other poultry by applying melted lard or vaseline to the top of the head, under the wings, and around the vent. Sodium fluoride dusted on the fowls will control all species of lice. To apply hold the fowl over a shallow pan and sift the powder through the feathers over all parts of the head and body. An ounce of the material is sufficient to treat 50 to 100 chickens.

Chicken Mites. These mites live in the cracks about the chicken house in the daytime and crawl upon the fowls at night or when nesting. The adults are 1/30 to 1/40 inch long, grayish in color, but when filled with blood are bright red to nearly black.

Control: Thoroughly clean the poultry house, spray it thoroughly with crude oil mixed with one half its volume of kerosene or a mixture of crank case oil and kerosene in about equal parts.

Chorioptic Mange of Horses. Chorioptic mange or symbiotic scabies, commonly known as foot mange, is caused by a mite which closely resembles the psoroptic mange mite. It lives on the surface of the skin and produces lesions similar to those produced by the psoroptic mite. The lesions of this mite are usually confined to the lower parts of the limbs around the foot and fetlock. The infested animals paw and kick and rub the infested foot with another foot or may try to bite the infested parts. Some of the hair comes out and the skin becomes hardened and thickened as a scaroptic mange.

Control: The remedies used for scaroptic mange are effective against this mite.

Chrysanthemum Gall Midge. The adult is a very small fly, resembling a mosquito in appearance except that its body is yellowish or orange. Eggs are laid on tender shoots and new growth. When a maggot emerges from the egg, it crawls over the surface of the leaf for a time, then eats into it, causing a gall formation in which it continues to live and grow. Infestations are detected by the hard, blister-like galls on the leaves or stems.

Control: Pick and destroy infested leaves as soon as they are observed. Spray infested plants at intervals of about 10 days, using 1 teaspoon of 40 per cent nicotine sulphate to ¾ gallon of water in which has been dissolved a piece of soap the size of a large walnut.

Cicadas. Cicadas sometimes injure apple trees by laying their eggs in the small branches. In depositing the eggs, the female raises the wood beneath the bark until it extrudes in splinter-like pieces and the injury may so weaken the branches that they break off. These insects are commonly known as "locusts" and are readily identified by the shrill singing of the males on hot summer days.

Control: No control method is known.

Clothes Moths (Webbing). The webbing clothes moth is a serious pest on substances made from animal hair, wool, or feathers and annually causes heavy loss in woolen clothing, furs, upholstered furniture, etc. The moth is very light brown and scarcely ¼ inch in length. It flits about in an erratic manner and but brief glimpses of it are obtained in the evening or at night for it avoids bright light. Moths deposit their eggs on substances which will later be used as food by the larvae. As soon as the eggs hatch the

of the summer generations are laid on the leaves. This mite spins but very little webbing on the leaves.

Control: Control is obtained by killing the over-wintering eggs with a dormant oil spray, using 4 gallons of dormant oil emulsion in 96 gallons of water. Should the dormant spray be omitted, control in the summer may be obtained with an oil spray, using 1½ gallons summer-type oil emulsion plus ¼ pound of colloidal spreader in 99 gallons water. This spray kills both the eggs and the mites and should be applied early in the summer before the mites have done serious damage. To prevent spotting of the fruit, the spray should be applied before the bloom appears on the fruit, or usually before June 20.

Eye-Spotted Bud Moth. The chocolate-brown larvae are about ⅓ inch long when mature. Larvae hiberate in small cocoons on the bark and in the spring eat the leaf and blossom buds, especially of prune, and frequently tie buds together with silk. Moths appear in mid-summer and deposit their eggs singly or in clusters on the under surfaces of the leaves. There is one generation annually.

Control: Spray with lead arsenate, 3 pounds to 100 gallons of water, just as leaves are showing green in the spring. Pay special attention to the tips of branches.

Fall Webworm. Fall webworms attack many kinds of fruit trees and native shrubs. Their presence is detected by loosely woven, dirty white webs which enclose the foliage on the ends of the branches. Webs enclose many pale yellow, black spotted, very hairy caterpillars which feed upon the surface of the leaves. Webs are very unsightly due to the presence of the black pellets of excrement of the larvae.

Control: Webs are readily removed by clipping off the terminal twigs which are enclosed in them and burning them. They may be burned out of the trees by the use of a kerosene-saturated burlap sack fastened to the end of a long pole. Spraying with lead arsenate or dusting with calcium arsenate controls them where infestations are extensive.

False Chinch Bug. They are small, brown to black, flat-bodied bugs that suck sap from the leaves. When numerous, they cause leaves to wilt, turn brown and become crisp. They usually attack cultivated crops only in weedy areas or after weeds in adjacent fields dry up following drought periods in the summer.

Control: Destroy weeds and do not plant crops susceptible to injury near waste or weedy areas. Plow under weeds the fall before fields are to be planted and destroy weeds in the early spring to prevent breeding of bugs which later migrate to cultivated crops. When hordes are migrating they may be checked by plowing a

furrow, keeping the bottom dry and dragging a log in the furrow to kill the bugs and to keep the soil in a dusty, loose condition.

False Wireworms. These are yellow, shiny worms measuring about 1 inch in length at maturity. They destroy planted kernels and sprouts of dry-farmed wheat both in the early spring and the late fall. Adults are large black beetles readily recognized by their habit of "standing on their head" when disturbed. Adults feed on wheat, various grasses, and weeds. Adults emerge in August, winter in protected places, and deposit their eggs in the soil the following spring. Larvae hatch in May and continue to feed and grow in the soil until mid-summer of the following year, when they pupate. It requires two years, therefore, to complete the life cycle. A smaller species also occurs in dry-farmed areas and predominates in certain localities. Its life cycle is quite similar and it responds to the same control measures as those for the larger species.

Control: Beetles eat poisoned bran bait freely and are cheaply controlled by its use. (See page 66 for preparation. Paris green is somewhat more effective than white arsenic.) Scatter the bait along fence rows, road sides, among rocks, and in waste places where beetles congregate. Make applications about September 15 on two successive years.

Firebrat. This insect lives in warm, moist places in dwellings and sometimes causes damage by eating paper products, book bindings, etc. Adults attain a length of about ½ inch and are recognized by two very long antennae and three long appendages on the rear of the body. They move very quickly.

Control: Clean out breeding areas, destroy debris, etc., which furnish protection and food. A poisoned bait, composed of 1 pound of finely ground or cut oatmeal, 1 ounce of white arsenic, ½ ounce of granulated sugar, and ¼ ounce of salt, is quite effective in control. Mix together the oatmeal, white arsenic, sugar, and salt. Moisten the mixture with water to bind the substances together thoroughly. Then dry the bait thoroughly to prevent mold, and crush it up into small bits. Scatter the bait lightly behind bookcases, radiators, on shelves, etc., and in other places frequented by the insects. It is effective over long periods of time without renewal. Sodium fluoride or sodium fluosilicate may be used in place of white arsenic.

Fleas. Adult fleas are very spiny, greatly flattened from side to side, wingless insects, with long legs fitted for jumping. They are light to dark brown in color. The slender, white larvae live in the bedding of animals, where they feed upon any available organic matter. While cat and dog fleas usually are found on their respective hosts, they will also attack humans.

Control: The best treatment of pets is the frequent application of dusts containing rotenone to all parts of the body. The animals'

sleeping quarters should be cleaned thoroughly, and sprayed or dusted with pyrethrum or rotenone to kill the larval stages.

Follicle Mites. Follicle mites sometimes infest hogs. They live in the hair follicules about the muzzle, eyes, base of tail, or on the tender skin on the inner sides of the legs. The skin becomes red and inflamed and small hard pimples, ranging in size from that of a pinhead to lumps as big as marbles, form and break. The discharge is a yellowish, cheesy pus.

Control: Since the mites burrow into the skin they are difficult to control and there is no way to cure an infested herd. Crude oil dips have kept these mites in check in the University of Idaho herd. The infested animals should be fattened and slaughtered and the premises cleaned with a spray of 1 part lime-sulphur in 15 parts of water, kerosene emulsion or one of the commercial dips before restocking with healthy hogs.

Forest Tent Caterpillar. These caterpillars collect in dense masses on branches of trees. They are dusky brown with a fine yellowish-brown stripe down the back and on each side. They may attain a length of about 2 inches when mature. They often strip the foliage from native trees and from fruit trees. Their eggs are deposited in a complete ring around the smaller twigs and are closely cemented together. There is one generation annually.

Control: Spray with lead arsenate, 3 pounds to 100 gallons of water, or dust with calcium arsenate.

Four-Spotted Tree Cricket. This cricket closely resembles the snowy tree cricket but is found more generally on plants with pithy stems, such as raspberries or grapes. Eggs are deposited through the bark and into the central pith and are laid in series. The life history is similar to that of the snowy tree cricket.

Control: Prune out, in the spring, canes containing eggs. In severe infestations in berry patches, spray the plants heavily with lead arsenate, 2 pounds to 100 gallons of water, as soon as the berry crop is harvested. This reduces the infestation the following year.

Fruit Tree Leaf Roller. Moths are a little less than ½ inch long, fawn colored or rusty brown, and have a prominent light spot on the outer margins of the wings. They appear in mid-summer and lay their eggs in irregular flat masses on the bark. Eggs are entirely covered with a grayish cement-like substance. Larvae hatch about the time the buds begin to open and are quite active, crawling backward about as well as forward and often may be observed hanging from the tree by a thread. The caterpillars roll the leaves, eating ragged irregular holes in them and in extreme cases completely defoliate the trees.

Control: Spray the trees thoroughly with dormant-type oil emulsion to kill the eggs before they hatch. Spraying should be done before the buds begin to burst. In severe cases use the emulsion at the rate of 8 gallons to 92 gallons of water. One half of that dosage is sufficient in cases of light infestations or where orchards are being regularly sprayed with oil for San Jose scale control.

Garden Slug. These are slimy, shiny, dark green or gray creatures resembling snails. They injure strawberries where the berries come in contact with the ground.

Control: A bait recently developed has proved very satisfactory. The bait is prepared from 4 grams of metaldehyde, 1 quart of bran, and enough water to moisten. The bait is placed in very small piles about 1 foot apart near the plants to be protected, or near the hiding places of the slugs. Rain causes the bait to be less effective; therefore, the piles of bait should be protected from rain.

Gladiolus Thrips. The gladiolus thrips is a very small, slender insect measuring about 1/16 inch long. It feeds on the corms, leaves, buds, and flowers of the gladiolus. The larva and pupa are lemon yellow and are found mostly in the leaf sheath or the buds. The eggs are deposited within the tissues of the host plant. Only from 11 to 13 days are required in midsummer for development from the egg to the adult. The adult overwinters in Idaho in the corms only.

Control: Reduce corm infestation at harvest by cutting off the tops, but avoid shaking the thrips over the corms during the process. Remove the corms from the field as soon as possible after topping. Place the corms in tight bags and sprinkle naphthalene flakes over them during the winter. Allow this material to remain on the corms for about 4 weeks, after which the excess material should be shaken out. Immersion of corms in hot water at 112° F. for 20 minutes kills all stages of the insect. This method is useful just before planting. The following spray may be used in the field with good results: Tartar emetic 2 ounces, brown sugar 8 ounces, water 3 gallons. Apply with a sprayer with sufficient pressure to produce a very fine spray. Spraying should be done early, when "silvered" spots are first noticed on the foliage. If spraying is delayed until the flower spikes appear, little can be done to save the flowers.

Gooseberry Fruit Worm. The larva is about ¾ inch long when mature and has a black head. Larvae eat into gooseberries in the spring. Infested berries usually color prematurely and dry up on the bushes or fall to the ground. Larvae make their way into the ground where they pupate and pass the winter in this stage.

Control: Infestations can be kept low by carefully removing and burning all trash and leaves beneath and around the bushes

in the autumn, and thoroughly cultivating around the bushes in the fall and early spring to destroy the overwintering pupae. A high degree of control is attained by spraying the bushes with powdered derris containing 5 per cent rotenone at the rate of 4 pounds in 100 gallons of water just as the worms begin to web the berry clusters together.

Granary Weevil. This mahogany-brown beetle is slightly more than 1/8 inch long, and has a head that is prolonged into a slender snout. The beetles feed upon grain and grain products and the grubs live inside the kernels of grain.

Control: In the household the same precautionary measures recommended for the saw-toothed grain beetle are satisfactory for this insect. Storage bins should be cleaned before new grain is placed in them. Small quantities of infested grain may be fumigated by the use of 1 ounce of carbon disulphide to every 100 pounds of seed closely enclosed in a tight container. Pour the carbon disulphide into a shallow receptacle on top of the grain, close the container and allow it to remain closed for 48 hours. The vapor is very inflammable and must not be handled near a flame of any kind.

Grape Leafhopper. This sucking insect is only about 1/8 inch long when mature and varies in color from yellowish green to red. Adults fly but nymphs are wingless. Adults hibernate and then make their way to grape leaves about June 1. They deposit their eggs on the under surfaces of the leaves. The young leafhoppers hatching from these eggs feed on the under surfaces of the leaves until they reach the adult stage, sometime in July. A second generation develops in the late summer. Injury is caused by both adults and young. A discolored area develops around each feeding puncture and when leafhoppers are abundant the entire leaf may become discolored and have a scorched appearance.

Control: Overwintering adults are rarely numerous enough in Idaho to cause injury, and they are very difficult to kill. It is best to watch for the appearance of the young on the under surfaces of the leaves in June and when the first of these begin to reach the adult stage to spray the vines thoroughly with 40 per cent nicotine sulphate or pyrethrum extract 3/4 pint, summer-type oil emulsion 1 gallon, and water 99 gallons. Use high pressure and direct the stream upward so that the under surfaces of the leaves are heavily covered.

Grasshoppers. Grasshoppers eat the foliage, blossoms, seeds, and fruits of many crops. Several species are of economic importance in the state, all having similar life habits and responding to the same control methods. Eggs are laid in the ground in pods containing from about 15 to 100 eggs each. The pods are inserted in

the soil at depths varying from very shallow to about 3 inches. Eggs are laid most abundantly in firm ground or sod along ditches, roadsides, fence rows, and waste places. Eggs are surrounded by a protective secretion and in their position in the ground are not greatly influenced by climatic conditions. Young 'hoppers hatch in the spring as soon as the soil surface becomes warm.

Control: The most dependable and economical method of control is to scatter poisoned bran bait prepared as described on page 66. It should be scattered at the rate of 10 pounds per acre in the morning as early as the 'hoppers become active. The greatest returns from the bait are obtained when 'hoppers are small and before they have begun to migrate, but it may be used successfully to protect crops at any time during the growing season. In alfalfa and clover seed fields and in grain crops, gardens, etc., it is necessary to scatter it generally throughout the field. When grasshoppers attack alfalfa hay crops it is usually just before the first crop is cut. In such cases a strip of alfalfa should be left uncut in the center of the land and heavily treated with bait to kill the 'hoppers concentrated there to prevent them from attacking the tender plants of the second crop.

Spring-toothing of infested fields late in the fall destroys many eggs by exposure. Thorough and frequent discing where practicable, or plowing late in the fall, destroys many eggs.

In gardens and around ornamentals, bush fruits, etc., the poisoned bait is quite effective, but at times 'hoppers will stay on the plants destroying flower buds and foliage. In such cases they are repelled and prevented from doing damage by thoroughly spraying the plants with lead arsenate at the rate of 4 pounds to 100 gallons of water.

Greenhouse Leaf Tyer. This insect is named from its habit of spinning light webs inclosing leaves in the web. It causes injury by destroying the under surfaces of the leaves. The larva is light green marked by lengthwise light stripes. It is very active, moving either backward or forward and often lowers itself on a silken thread.

Control: Suspend shallow pans 5 or 6 inches beneath clear glass incandescent lamps above the greenhouse benches. In the pans keep a supply of water and kerosene. Moths are attracted to the lights and captured in the traps beneath. Lamps should be turned on within an hour after sundown and allowed to burn for 2 or 3 hours. For control of the larvae, infested plants should be sprayed with lead arsenate at the rate of 1 pound to 25 gallons of water, or dusted with a mixture of fine dusting sulphur 6 parts, and lead arsenate 1 part.

Greenhouse Thrips. These small, narrow-bodied insects vary in color from yellow to brown or almost black. They injure both leaves

and blossoms of many greenhouse plants. They have mouth parts fitted for piercing and scraping the leaf surface and for sucking the exuding sap. Injured leaves or petals become covered with whitish or silvery blotches which later run together causing dead areas. There are many generations annually, and infestations breed up so rapidly that injury develops suddenly.

Control: Spray with 40 per cent nicotine sulphate, 1 teaspoon in ¾ gallon of water, in which has first been dissolved a piece of soap the size of a large walnut; or dust with nicotine dust containing 2.4 per cent actual nicotine. (See page 66 for preparation of nicotine dust.) Direct the applications at the under sides of the leaves and repeat at weekly intervals as long as needed.

Greenhouse Whitefly. The tiny, 4-winged, white, powdery adults are about 1/16 inch long. They are readily observed while resting on the under sides of the leaves. If numerous they rise in small white clouds when disturbed. The young are less than 1/25 inch long. They are oval, flat, scale-like, and pale green in color. Fine waxy threads of various lengths radiate from the body. Adults and young both feed on the leaves, sucking the juices. Injured plants turn yellow, wilt, and may die.

Control: Whiteflies are probably best controlled by repeated fumigations with calcium cyanide used at the rate of ½ ounce per 1000 cubic feet of space. Fumigations should be spaced about 2 weeks apart until the infestation is eradicated. In using calcium cyanide follow the directions of the manufacturers.

Green Peach Aphid. This green plant louse injures new growth and curls terminal foliage. It winters in the egg stage. Eggs are black and shiny and are deposited in crevices in the bark and around the bases of buds. Eggs hatch just before the buds open in the spring.

Control: Dormant-type oil emulsion applied just before the buds open is fairly effective in control. If the dormant spray is lime-sulphur it should be delayed until just before the buds open and ¾ pint of 40 per cent nicotine sulphate added to each 100 gallons of dilute spray. For foliage sprays use ¾ pint of 40 per cent nicotine sulphate or pyrethrum extract and ½ gallon summer-type oil emulsion to 100 gallons of water.

Green Plant Bug. This plant bug, or stink bug, is about ½ inch long and is colored bright green. It sometimes seriously injures the heads of standing wheat by destroying the developing kernels.

Control: No practical method of control is known. Spring burning of weeds and trash in infested fields and weedy roadsides will reduce somewhat the numbers of the bugs.

Hog Louse. The hog louse is a sucking louse. It is a large, bluish-gray louse nearly ¼ inch long when mature. The lice torment the hogs by piercing the skin and thus cause the animal to rub. The skin becomes thick, cracked, tender and sore, and the animals become restless and unprofitable.

Control: The best method of control on a small herd of swine is the application of a thin, even coat of oil over the animals' bodies with a fine-bristled brush. Especial attention should be given to the inside of the ear, the folds of the skin about the neck and the inner surfaces of the thighs, to be sure that all eggs are covered with oil. The following oils are recommended: crude petroleum, raw linseed oil, half-and-half kerosene and lard, and equal parts kerosene and cottonseed oil. The hogs must be kept out of the sun and not driven or excited for a day after the treatment.

Hog Mange. Hog mange is caused by the scaroptic mange mite as described under "horse mange" and may be controlled by the same methods used for hog lice.

(Hollyhock) Aphid. These dark red plant lice cluster on buds and leaves causing them to wilt and wither and often preventing blossoming.

Control: Spray with 40 per cent nicotine sulphate or pyrethrum extract, 1 teaspoon to ¾ gallon of water in which is dissolved a piece of soap the size of a large walnut. Make applications as soon as the first aphids are observed and repeat if necessary.

Hollyhock Beetle. This oval-shaped beetle is about 3/8 inch long. The head and thorax are black, wing covers are yellow to orange with irregularly shaped black lines extending lengthwise. Beetles severely eat the leaves of hollyhocks, especially those near the soil. They may be found underneath leaves or trash beneath injured plants.

Control:Dust with 1 per cent rotenone or spray the leaves with lead arsenate or calcium arsenate at the rate of 1 pound to 25 gallons of water.

Hop Looper. The grayish-brown moth is between ½ and ¾ inch long. The mouth parts project forward from the head resembling a snout. Caterpillars are pale green, about ⅝ inch long when mature. They feed on the leaves of ornamental hops, causing a ragged, unsightly appearance.

Control: Dust the vines with pure calcium arsenate or lead arsenate, or spray with lead arsenate, 3 pounds to 100 gallons of water. Apply when the first holes are observed in the leaves and repeat 2 or 3 weeks later if necessary.

of the summer generations are laid on the leaves. This mite spins but very little webbing on the leaves.

Control: Control is obtained by killing the over-wintering eggs with a dormant oil spray, using 4 gallons of dormant oil emulsion in 96 gallons of water. Should the dormant spray be omitted, control in the summer may be obtained with an oil spray, using 1½ gallons summer-type oil emulsion plus ¼ pound of colloidal spreader in 99 gallons water. This spray kills both the eggs and the mites and should be applied early in the summer before the mites have done serious damage. To prevent spotting of the fruit, the spray should be applied before the bloom appears on the fruit, or usually before June 20.

Eye-Spotted Bud Moth. The chocolate-brown larvae are about ⅓ inch long when mature. Larvae hiberate in small cocoons on the bark and in the spring eat the leaf and blossom buds, especially of prune, and frequently tie buds together with silk. Moths appear in mid-summer and deposit their eggs singly or in clusters on the under surfaces of the leaves. There is one generation annually.

Control: Spray with lead arsenate, 3 pounds to 100 gallons of water, just as leaves are showing green in the spring. Pay special attention to the tips of branches.

Fall Webworm. Fall webworms attack many kinds of fruit trees and native shrubs. Their presence is detected by loosely woven, dirty white webs which enclose the foliage on the ends of the branches. Webs enclose many pale yellow, black spotted, very hairy caterpillars which feed upon the surface of the leaves. Webs are very unsightly due to the presence of the black pellets of excrement of the larvae.

Control: Webs are readily removed by clipping off the terminal twigs which are enclosed in them and burning them. They may be burned out of the trees by the use of a kerosene-saturated burlap sack fastened to the end of a long pole. Spraying with lead arsenate or dusting with calcium arsenate controls them where infestations are extensive.

False Chinch Bug. They are small, brown to black, flat-bodied bugs that suck sap from the leaves. When numerous, they cause leaves to wilt, turn brown and become crisp. They usually attack cultivated crops only in weedy areas or after weeds in adjacent fields dry up following drought periods in the summer.

Control: Destroy weeds and do not plant crops susceptible to injury near waste or weedy areas. Plow under weeds the fall before fields are to be planted and destroy weeds in the early spring to prevent breeding of bugs which later migrate to cultivated crops. When hordes are migrating they may be checked by plowing a

furrow, keeping the bottom dry and dragging a log in the furrow to kill the bugs and to keep the soil in a dusty, loose condition.

False Wireworms. These are yellow, shiny worms measuring about 1 inch in length at maturity. They destroy planted kernels and sprouts of dry-farmed wheat both in the early spring and the late fall. Adults are large black beetles readily recognized by their habit of "standing on their head" when disturbed. Adults feed on wheat, various grasses, and weeds. Adults emerge in August, winter in protected places, and deposit their eggs in the soil the following spring. Larvae hatch in May and continue to feed and grow in the soil until mid-summer of the following year, when they pupate. It requires two years, therefore, to complete the life cycle. A smaller species also occurs in dry-farmed areas and predominates in certain localities. Its life cycle is quite similar and it responds to the same control measures as those for the larger species.

Control: Beetles eat poisoned bran bait freely and are cheaply controlled by its use. (See page 66 for preparation. Paris green is somewhat more effective than white arsenic.) Scatter the bait along fence rows, road sides, among rocks, and in waste places where beetles congregate. Make applications about September 15 on two successive years.

Firebrat. This insect lives in warm, moist places in dwellings and sometimes causes damage by eating paper products, book bindings, etc. Adults attain a length of about ½ inch and are recognized by two very long antennae and three long appendages on the rear of the body. They move very quickly.

Control: Clean out breeding areas, destroy debris, etc., which furnish protection and food. A poisoned bait, composed of 1 pound of finely ground or cut oatmeal, 1 ounce of white arsenic, ½ ounce of granulated sugar, and ¼ ounce of salt, is quite effective in control. Mix together the oatmeal, white arsenic, sugar, and salt. Moisten the mixture with water to bind the substances together thoroughly. Then dry the bait thoroughly to prevent mold, and crush it up into small bits. Scatter the bait lightly behind bookcases, radiators, on shelves, etc., and in other places frequented by the insects. It is effective over long periods of time without renewal. Sodium fluoride or sodium fluosilicate may be used in place of white arsenic.

Fleas. Adult fleas are very spiny, greatly flattened from side to side, wingless insects, with long legs fitted for jumping. They are light to dark brown in color. The slender, white larvae live in the bedding of animals, where they feed upon any available organic matter. While cat and dog fleas usually are found on their respective hosts, they will also attack humans.

Control: The best treatment of pets is the frequent application of dusts containing rotenone to all parts of the body. The animals'

sleeping quarters should be cleaned thoroughly, and sprayed or dusted with pyrethrum or rotenone to kill the larval stages.

Follicle Mites. Follicle mites sometimes infest hogs. They live in the hair follicules about the muzzle, eyes, base of tail, or on the tender skin on the inner sides of the legs. The skin becomes red and inflamed and small hard pimples, ranging in size from that of a pinhead to lumps as big as marbles, form and break. The discharge is a yellowish, cheesy pus.

Control: Since the mites burrow into the skin they are difficult to control and there is no way to cure an infested herd. Crude oil dips have kept these mites in check in the University of Idaho herd. The infested animals should be fattened and slaughtered and the premises cleaned with a spray of 1 part lime-sulphur in 15 parts of water, kerosene emulsion or one of the commercial dips before restocking with healthy hogs.

Forest Tent Caterpillar. These caterpillars collect in dense masses on branches of trees. They are dusky brown with a fine yellowish-brown stripe down the back and on each side. They may attain a length of about 2 inches when mature. They often strip the foliage from native trees and from fruit trees. Their eggs are deposited in a complete ring around the smaller twigs and are closely cemented together. There is one generation annually.

Control: Spray with lead arsenate, 3 pounds to 100 gallons of water, or dust with calcium arsenate.

Four-Spotted Tree Cricket. This cricket closely resembles the snowy tree cricket but is found more generally on plants with pithy stems, such as raspberries or grapes. Eggs are deposited through the bark and into the central pith and are laid in series. The life history is similar to that of the snowy tree cricket.

Control: Prune out, in the spring, canes containing eggs. In severe infestations in berry patches, spray the plants heavily with lead arsenate, 2 pounds to 100 gallons of water, as soon as the berry crop is harvested. This reduces the infestation the following year.

Fruit Tree Leaf Roller. Moths are a little less than ½ inch long, fawn colored or rusty brown, and have a prominent light spot on the outer margins of the wings. They appear in mid-summer and lay their eggs in irregular flat masses on the bark. Eggs are entirely covered with a grayish cement-like substance. Larvae hatch about the time the buds begin to open and are quite active, crawling backward about as well as forward and often may be observed hanging from the tree by a thread. The caterpillars roll the leaves, eating ragged irregular holes in them and in extreme cases completely defoliate the trees.

Control: Spray the trees thoroughly with dormant-type oil emulsion to kill the eggs before they hatch. Spraying should be done before the buds begin to burst. In severe cases use the emulsion at the rate of 8 gallons to 92 gallons of water. One half of that dosage is sufficient in cases of light infestations or where orchards are being regularly sprayed with oil for San Jose scale control.

Garden Slug. These are slimy, shiny, dark green or gray creatures resembling snails. They injure strawberries where the berries come in contact with the ground.

Control: A bait recently developed has proved very satisfactory. The bait is prepared from 4 grams of metaldehyde, 1 quart of bran, and enough water to moisten. The bait is placed in very small piles about 1 foot apart near the plants to be protected, or near the hiding places of the slugs. Rain causes the bait to be less effective; therefore, the piles of bait should be protected from rain.

Gladiolus Thrips. The gladiolus thrips is a very small, slender insect measuring about 1/16 inch long. It feeds on the corms, leaves, buds, and flowers of the gladiolus. The larva and pupa are lemon yellow and are found mostly in the leaf sheath or the buds. The eggs are deposited within the tissues of the host plant. Only from 11 to 13 days are required in midsummer for development from the egg to the adult. The adult overwinters in Idaho in the corms only.

Control: Reduce corm infestation at harvest by cutting off the tops, but avoid shaking the thrips over the corms during the process. Remove the corms from the field as soon as possible after topping. Place the corms in tight bags and sprinkle naphthalene flakes over them during the winter. Allow this material to remain on the corms for about 4 weeks, after which the excess material should be shaken out. Immersion of corms in hot water at 112° F. for 20 minutes kills all stages of the insect. This method is useful just before planting. The following spray may be used in the field with good results: Tartar emetic 2 ounces, brown sugar 8 ounces, water 3 gallons. Apply with a sprayer with sufficient pressure to produce a very fine spray. Spraying should be done early, when "silvered" spots are first noticed on the foliage. If spraying is delayed until the flower spikes appear, little can be done to save the flowers.

Gooseberry Fruit Worm. The larva is about ¾ inch long when mature and has a black head. Larvae eat into gooseberries in the spring. Infested berries usually color prematurely and dry up on the bushes or fall to the ground. Larvae make their way into the ground where they pupate and pass the winter in this stage.

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in the autumn, and thoroughly cultivating around the bushes in the fall and early spring to destroy the overwintering pupae. A high degree of control is attained by spraying the bushes with powdered derris containing 5 per cent rotenone at the rate of 4 pounds in 100 gallons of water just as the worms begin to web the berry clusters together.

Granary Weevil. This mahogany-brown beetle is slightly more than 1/8 inch long, and has a head that is prolonged into a slender snout. The beetles feed upon grain and grain products and the grubs live inside the kernels of grain.

Control: In the household the same precautionary measures recommended for the saw-toothed grain beetle are satisfactory for this insect. Storage bins should be cleaned before new grain is placed in them. Small quantities of infested grain may be fumigated by the use of 1 ounce of carbon disulphide to every 100 pounds of seed closely enclosed in a tight container. Pour the carbon disulphide into a shallow receptacle on top of the grain, close the container and allow it to remain closed for 48 hours. The vapor is very inflammable and must not be handled near a flame of any kind.

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Control: Overwintering adults are rarely numerous enough in Idaho to cause injury, and they are very difficult to kill. It is best to watch for the appearance of the young on the under surfaces of the leaves in June and when the first of these begin to reach the adult stage to spray the vines thoroughly with 40 per cent nicotine sulphate or pyrethrum extract 3/4 pint, summer-type oil emulsion 1 gallon, and water 99 gallons. Use high pressure and direct the stream upward so that the under surfaces of the leaves are heavily covered.

Grasshoppers. Grasshoppers eat the foliage, blossoms, seeds, and fruits of many crops. Several species are of economic importance in the state, all having similar life habits and responding to the same control methods. Eggs are laid in the ground in pods containing from about 15 to 100 eggs each. The pods are inserted in

the soil at depths varying from very shallow to about 3 inches. Eggs are laid most abundantly in firm ground or sod along ditches, roadsides, fence rows, and waste places. Eggs are surrounded by a protective secretion and in their position in the ground are not greatly influenced by climatic conditions. Young 'hoppers hatch in the spring as soon as the soil surface becomes warm.

Control: The most dependable and economical method of control is to scatter poisoned bran bait prepared as described on page 66. It should be scattered at the rate of 10 pounds per acre in the morning as early as the 'hoppers become active. The greatest returns from the bait are obtained when 'hoppers are small and before they have begun to migrate, but it may be used successfully to protect crops at any time during the growing season. In alfalfa and clover seed fields and in grain crops, gardens, etc., it is necessary to scatter it generally throughout the field. When grasshoppers attack alfalfa hay crops it is usually just before the first crop is cut. In such cases a strip of alfalfa should be left uncut in the center of the land and heavily treated with bait to kill the 'hoppers concentrated there to prevent them from attacking the tender plants of the second crop.

Spring-toothing of infested fields late in the fall destroys many eggs by exposure. Thorough and frequent discing where practicable, or plowing late in the fall, destroys many eggs.

In gardens and around ornamentals, bush fruits, etc., the poisoned bait is quite effective, but at times 'hoppers will stay on the plants destroying flower buds and foliage. In such cases they are repelled and prevented from doing damage by thoroughly spraying the plants with lead arsenate at the rate of 4 pounds to 100 gallons of water.

Greenhouse Leaf Tyer. This insect is named from its habit of spinning light webs inclosing leaves in the web. It causes injury by destroying the under surfaces of the leaves. The larva is light green marked by lengthwise light stripes. It is very active, moving either backward or forward and often lowers itself on a silken thread.

Control: Suspend shallow pans 5 or 6 inches beneath clear glass incandescent lamps above the greenhouse benches. In the pans keep a supply of water and kerosene. Moths are attracted to the lights and captured in the traps beneath. Lamps should be turned on within an hour after sundown and allowed to burn for 2 or 3 hours. For control of the larvae, infested plants should be sprayed with lead arsenate at the rate of 1 pound to 25 gallons of water, or dusted with a mixture of fine dusting sulphur 6 parts, and lead arsenate 1 part.

Greenhouse Thrips. These small, narrow-bodied insects vary in color from yellow to brown or almost black. They injure both leaves

and blossoms of many greenhouse plants. They have mouth parts fitted for piercing and scraping the leaf surface and for sucking the exuding sap. Injured leaves or petals become covered with whitish or silvery blotches which later run together causing dead areas. There are many generations annually, and infestations breed up so rapidly that injury develops suddenly.

Control: Spray with 40 per cent nicotine sulphate, 1 teaspoon in ¾ gallon of water, in which has first been dissolved a piece of soap the size of a large walnut; or dust with nicotine dust containing 2.4 per cent actual nicotine. (See page 66 for preparation of nicotine dust.) Direct the applications at the under sides of the leaves and repeat at weekly intervals as long as needed.

Greenhouse Whitefly. The tiny, 4-winged, white, powdery adults are about 1/16 inch long. They are readily observed while resting on the under sides of the leaves. If numerous they rise in small white clouds when disturbed. The young are less than 1/25 inch long. They are oval, flat, scale-like, and pale green in color. Fine waxy threads of various lengths radiate from the body. Adults and young both feed on the leaves, sucking the juices. Injured plants turn yellow, wilt, and may die.

Control: Whiteflies are probably best controlled by repeated fumigations with calcium cyanide used at the rate of ½ ounce per 1000 cubic feet of space. Fumigations should be spaced about 2 weeks apart until the infestation is eradicated. In using calcium cyanide follow the directions of the manufacturers.

Green Peach Aphid. This green plant louse injures new growth and curls terminal foliage. It winters in the egg stage. Eggs are black and shiny and are deposited in crevices in the bark and around the bases of buds. Eggs hatch just before the buds open in the spring.

Control: Dormant-type oil emulsion applied just before the buds open is fairly effective in control. If the dormant spray is lime-sulphur it should be delayed until just before the buds open and ¾ pint of 40 per cent nicotine sulphate added to each 100 gallons of dilute spray. For foliage sprays use ¾ pint of 40 per cent nicotine sulphate or pyrethrum extract and ½ gallon summer-type oil emulsion to 100 gallons of water.

Green Plant Bug. This plant bug, or stink bug, is about ½ inch long and is colored bright green. It sometimes seriously injures the heads of standing wheat by destroying the developing kernels.

Control: No practical method of control is known. Spring burning of weeds and trash in infested fields and weedy roadsides will reduce somewhat the numbers of the bugs.

Hog Louse. The hog louse is a sucking louse. It is a large, bluish-gray louse nearly ¼ inch long when mature. The lice torment the hogs by piercing the skin and thus cause the animal to rub. The skin becomes thick, cracked, tender and sore, and the animals become restless and unprofitable.

Control: The best method of control on a small herd of swine is the application of a thin, even coat of oil over the animals' bodies with a fine-bristled brush. Especial attention should be given to the inside of the ear, the folds of the skin about the neck and the inner surfaces of the thighs, to be sure that all eggs are covered with oil. The following oils are recommended: crude petroleum, raw linseed oil, half-and-half kerosene and lard, and equal parts kerosene and cottonseed oil. The hogs must be kept out of the sun and not driven or excited for a day after the treatment.

Hog Mange. Hog mange is caused by the scaroptic mange mite as described under "horse mange" and may be controlled by the same methods used for hog lice.

(Hollyhock) Aphid. These dark red plant lice cluster on buds and leaves causing them to wilt and wither and often preventing blossoming.

Control: Spray with 40 per cent nicotine sulphate or pyrethrum extract, 1 teaspoon to ¾ gallon of water in which is dissolved a piece of soap the size of a large walnut. Make applications as soon as the first aphids are observed and repeat if necessary.

Hollyhock Beetle. This oval-shaped beetle is about 3/8 inch long. The head and thorax are black, wing covers are yellow to orange with irregularly shaped black lines extending lengthwise. Beetles severely eat the leaves of hollyhocks, especially those near the soil. They may be found underneath leaves or trash beneath injured plants.

Control:Dust with 1 per cent rotenone or spray the leaves with lead arsenate or calcium arsenate at the rate of 1 pound to 25 gallons of water.

Hop Looper. The grayish-brown moth is between ½ and ¾ inch long. The mouth parts project forward from the head resembling a snout. Caterpillars are pale green, about ⅝ inch long when mature. They feed on the leaves of ornamental hops, causing a ragged, unsightly appearance.

Control: Dust the vines with pure calcium arsenate or lead arsenate, or spray with lead arsenate, 3 pounds to 100 gallons of water. Apply when the first holes are observed in the leaves and repeat 2 or 3 weeks later if necessary.

Horn Fly. The horn fly is a close relative of the stable fly, and its harmful effect on cattle is very similar. It pierces the skin to suck the blood, causing pain and annoyance, and interferes with the feeding and resting of the cattle so that they lose weight and drop in milk production. They are small flies, about half as big as the house fly or the stable fly, and hover over the backs of cattle all summer long. They crawl down between the hairs on the withers, back, or belly and suck blood.

Control: No satisfactory control has yet been devised for these flies. Darkened stables, with curtains or brush arranged over the entrance to brush the flies off as the cattle go in, give a measure of relief. Repellant sprays applied at the time of milking give temporary relief. The destruction of their breeding places by daily removal of all manure from feed lots to the field during fly seasons greatly reduces populations of the fly.

Horse Biting Lice. Horse biting lice are not often severe pests of horses, but they occasionally become sufficiently numerous on horses to cause severe irritation and itching. Horses will often rub, bite, stamp, kick, and otherwise manifest extreme uneasiness, in an effort to relieve themselves of the irritation. The coat becomes roughened, and frequent rubbing destroys the hair in patches, often causing bruises or wounds in the skin. The lice usually are found on the sides of the neck, around the flank, and on the jaw. They are found on all parts of the body in severe infestations. The eggs are attached to the individual hairs on the body and require about 8 or 10 days to hatch.

Control: Control methods should be repeated so as to kill the young lice hatched from the eggs already on the animal at the time of the first treatment. Usually two treatments are necessary. The dips commonly used for the control of all lice on horses and mules are as follows: arsenical solution, coal-tar, or nicotine dips. The first and last are poisonous and should be handled with due precaution or injury to both man and animals may result. Follow the manufacturers' directions given on the container in which the dip is purchased. Dipping vats are so arranged that the insecticide is deep enough in the vat that the animals will need to swim through it so as to immerse most of their bodies. The head should be completely submerged at least once while the animal is in the vat.

Hand applications of dusting powders and oils are used most often in treating horses for lice. Biting lice can be controlled with sodium fluoride applied in the form of a powder to the skin of the horse. The best method is to apply the powdered insecticide from a shaker-top can to the affected parts and follow the application with a minimum amount of grooming so that the powder will sift into the hair. Lice are controlled by the application of a

small amount of raw linseed oil applied to the hair of the horse with a grooming brush.

A dust containing not less than 2 per cent rotenone may be used in place of sodium fluoride, but must be repeated in 2 weeks to kill lice hatching from eggs. Three or four ounces per animal is sufficient.

Horse Botfly. Three species of botflies attack horses. The horse botfly, while depositing its eggs, does not annoy the horse as much as the other two species. The body of the female is covered with bands of black and yellow hair. Each of its wings bears a dark band. The abdomen is curved under in characteristic shape. The fly hovers about the horse while attempting to deposit eggs. The eggs are glued to hairs on the inner sides of the knees, and on the outsides of the forelegs, on the shoulders, belly, neck, and flank.

Control: Several things can be done to protect horses from the attack of the egg-laying botflies. No known repellants are entirely effective. A mixture of equal parts of pine tar and lard applied to the areas where the flies lay the eggs is effective for about 4 days in keeping the flies from laying their eggs. The use of blankets or nets tends to aid the animals in fighting away the botflies. The best treatment for ridding the animals of this pest is the administration of carbon disulphide, but this is successful only when applied on a community-wide basis. The carbon disulphide is prepared in capsule form. It should be administered only by a veterinarian, for if the capsules are not properly administered or are broken during the process, death of the animal is likely to result. The greatest efficiency in the use of the treatment is obtained during the winter months, preferably in December or January.

The first step in the control of botflies is the application of a solution of 3 per cent (1 ounce to a quart) of a good coal-tar dip in warm water to the hair where the eggs are attached. This treatment should be followed in about 30 days with the carbon disulphide treatment. This long interval is necessary to allow the larvae which have already entered the body of the horse time enough to reach the digestive tract where they will be killed by the treatment.

Horse Flies. Several flies which may be called horse flies belong to a group known as tabanids. These insects are notorious as tormenters of horses on pasture and in the harness. They are blood suckers, and, in piercing the skin to obtain the blood, they greatly annoy horses. They also attack other livestock and man. Besides being pests, horse flies have been shown to be carriers of certain diseases of animals such as anthrax, anaplasmosis of cattle, and certain trypanosome diseases.

Control: Little is known of how to control these pests on domestic livestock, but the best protective method is to prevent attack of the insects mechanically by nets, blankets, muzzles, etc.

Horse Sucking Lice. One species of sucking louse is found on horses, and it may be distinguished easily from the horse biting-louse in that it is large and has a long, pointed head, whereas the biting lice have short, rounded, blunt heads. The eggs are attached to the hairs, usually close to the skin, and hatch in from 11 to 20 days. These lice spend their entire lives on the horses and will live only a few days when removed.

Control: They are controlled in the same way as biting-lice.

House Fly. This loathsome insect breeds in all kinds of filth, garbage, human excrement, manure, etc. It is a filth and disease carrier. Its presence is indicative of filth some place nearby.

Control: Burn, bury, or dispose of garbage immediately. Keep garbage cans covered. Protect foods by screening. Keep stables clean. Haul manure away at least once a week and spread it where it is exposed to sunshine. Fly populations around barns, homes, stores, etc., can be greatly reduced by the use of traps, a number of which are on the market. Proprietary poisons and sticky fly preparations that greatly aid in reducing the numbers of flies are also on the market. A good fly poison may be made cheaply by mixing together 1 tablespoon of 40 per cent formalin, ¼ pint of sweet milk or buttermilk, and ¼ pint of water. Expose this mixture in shallow dishes to the flies. Many proprietary sprays on the market will stupefy flies after which they may be swept up and burned.

Indian-Meal Moth. The adult moth is about ½ inch long. The base of the forewing is grayish white, and the tip half is reddish brown. Larvae are of a general white color and are ⅓ to ½ inch long when fully grown. The larvae feed upon a great variety of food materials. Infested material is often webbed together and fouled with dirty silken masses.

Control: Control is the same as for the saw-toothed grain beetle.

Lace Bugs. These small, flat, sucking insects feed on the lower surfaces of leaves of many plants. The head and body frequently are completely hidden by the lace-like covering of the thorax and the wings. This lace-like covering is often nearly transparent, showing many veins. Adults are about ⅛ inch long. The young are darker in color, often covered with spines, and do not resemble the adults. Injured leaves show light flecked areas and quantities of dark pellets of excrement.

Control: Spray with 40 per cent nicotine sulphate or with pyrethrum extract at the rate of 2 teaspoons to 1 gallon of soapy

water. Direct the spray so that it will hit the insects in flight and so it also will cover the lower surfaces of the leaves.

Larder Beetle. The brown, hairy larva of the larder beetle is occasionally found in woolen fabrics and in food materials. It is very sluggish of movement. The beetle is about ¼ inch long, black in color, with a wide, pale yellow band running cross-wise on the wing covers.

Control: Houses severely infested should be fumigated (send to the Idaho Agricultural Experiment Station for special instructions). Moderate infestations should be cleaned out as directed for the saw-toothed grain beetle.

Leaf-Curl Plum Aphid. The first forms of this plant louse which appear in the spring are deep red or brownish red with brown bands cross-wise on the back. The young from these are uniformly pale green. Overwintering eggs on the bark hatch in the spring before the fruit buds of prune show signs of swelling. When leaves appear they are severely curled from the effects of the feeding of this aphid. Several generations develop on peach, prune, or plum trees before leaving for other plants.

Control: Add ¾ pint of 40 per cent nicotine sulphate or pyrethrum extract to each 100 gallons of dormant lime-sulphur or oil emulsion sprays and make the application just before the blossom buds open in the spring.

Leaf Cutter Bees. These wild bees cut large, circular holes in the margins of the leaves of rose, Virginia creeper, lilac, etc., causing an unsightly, ragged appearance.

Control: Spray the bushes with lime-sulphur, 1 part to 40 parts of water, to repel the bees. Make the first application when damage is first observed and repeat if necessary later in the season.

Leatherjackets. These tough, slate colored, tapering larvae may usually be identified by the scalloped "hood" at the rear end of the body. They are the larvae of craneflies, insects that resemble huge mosquitoes. They sometimes feed on strawberries and root crops near the surface of the ground and rest shallowly in the soil in protected places, beneath trash, etc.

Control: Cultivate the soil thoroughly near the plants and eliminate debris. Examine under leaves, hand-pick and destroy larvae. Scatter poisoned bran mash (directions for preparation, page 66) over the surface of the ground and closely around plants.

Legume Bugs. (Previously called tarnished plant bug.) Two species occur in Idaho. These sucking insects cause puncturing of beans, blossom drop in alfalfa, decreased yield of alfalfa hay and seed, as well as injury to many other plants. Adults are about ¼ inch long, of general flat triangular shape and are quite active. The "legume bug" is yellowish green and between the wings on the back has a small triangular area with a yellowish green v-shaped mark. The "pale legume bug" is much lighter colored than the legume bug and the v-shaped mark on the triangular area between the wings is brilliant green. These bugs breed freely on legume plants, especially alfalfa, and fly to bean fields when such crops are cut.

Control: No satisfactory means of controlling legume bugs is yet known. In the case of beans it seems possible to reduce the injury by delaying the cutting date of second-crop alfalfa in adjacent fields for a week or 10 days. Clean cultivation of areas to be planted, the disposal of crop residues, and destruction of weed patches where the insects spend the winter aid in reducing infestations.

Lima Bean Pod Borer. The small gray moths have a broad white band and an ochreous band across the forewings. They are very active and appear in the early spring. The caterpillars vary from white to pale green or red and attain a length of about 1 inch. They commonly infest the green pods of many legumes, in which they eat out large portions of the seeds. Most varieties of beans, peas, and the pods of locust and wild vetch may be attacked. There is only one generation a year. This insect is seldom present in large numbers in Idaho.

Control: There is no satisfactory control for this insect.

Mealybugs. These small, sluggish, white, soft-bodied insects cluster on the under sides of leaves or in leaf axils. They vary in size up to about ¼ inch long. They suck the juices from the stems and leaves, discoloring and deforming the foliage.

Control: Control is extremely difficult, for insecticides strong enough to insure kills of the insects often injure tender greenhouse plants. Probably the most practicable control is to spray with nicotine sulphate or pyrethrum extract, at the rate of 1 teaspoon to ¾ gallon of water, adding 2 teaspoons of summer-type oil emulsion. Spraying should begin before infestations build up to any extent and applications repeated until control is established.

Mealy Plum Aphid. This bluish-green plant louse covered with a white, powder-like secretion, becomes exceedingly abundant on the under surfaces of the leaves early in the spring. It is accompanied by heavy honey-dew causing a sticky secretion that drops on the upper surfaces of the leaves.

Control: Spray thoroughly with 1 gallon of summer-type oil emulsion in 99 gallons of water and add ¾ pint of 40 per cent nicotine sulphate or pyrethrum extract. Use pressure and material sufficient to wet through the "mealy" covering and make application as soon as infestations are observed in the spring.

Mediterranean Flour Moth. Larvae of the Mediterranean flour moth are nearly ¾ inch long when mature, are whitish, and have dark heads. They spin silken threads and form tunnels in the flour or other cereal products. Adults are dark gray moths that may be found in flour mills or dwellings throughout the year.

Control: Follow the recommendations for saw-toothed grain beetle.

Mineola Moth. Fully grown larvae are slightly more than ½ inch long. They are a red-brown color, being uniformly darker from the middle of the side of the body upward than from the middle of the side downward. Legs are black and the head light brown. Partially grown larvae winter in heavy webs on the bark, become active about the time prune blossoms begin to swell, and enter the blossom buds. Larvae pupate in the soil. Moths deposit their eggs singly on the under surface of the leaves. Part of the insects have but one generation annually. Others pass through a second generation while some of them have three generations annually. Newly hatched larvae enter the fruits. Larvae feed only in flower buds or in the fruit, never on leaves.

Control: There is some evidence that where lime-sulphur is used annually as the dormant San Jose scale spray, infestations of Mineola are light. The best means of direct control yet found is to spray with dormant-type oil emulsion 4 gallons, water 96 gallons, and 2⅔ pints of pyrethrum extract (oil extract containing 2.15 grams pyrethrins per 100 cc.) Mix oil emulsion and water as for oil spray and then add pyrethrum. In home-made emulsions, or with the tank-mix, first combine the pyrethrum with the oil and then emulsify. Make applications when the prune buds are swelling and show green at the tips and just before beginning to show white.

Monterey Pine Scale. The adult Monterey pine scale is a large semi-globular reddish brown or black, smooth, shiny species which occurs at the bases of the needles on the tips of the twigs of Monterey and other pines. It produces large quantities of honeydew and often seriously injures young trees. Closely related species occur on spruces and firs.

Control: No control is known.

Mormon Cricket. Adults are dark brown to black and from 1¼ to 1½ inches long. They are wingless. Nymphs are from

about 3/16 inch to 1 inch long. They are variously colored in shades of green, red, brown, and black. Eggs are about the size and shape of grains of rye and are gray or bluish in color. They are deposited singly and shallowly in the soil or in bunches of grass, usually away from cultivated areas. Eggs are laid between June 15 and September 1 and begin hatching about April 1. Nymphs are closely banded together just after hatching, and a band that later in the season may cover several acres is then confined to a relatively small area. As the nymphs grow, they begin moving, migrating bands often being of large size and frequently reaching cultivated fields. Mormon crickets are general feeders, but their food preference is distinctly for some of the native plants, and they do not often cause serious damage to cultivated crops.

Control: The best means of control is to apply a mixture of sodium arsenite, 1 part, and hydrated lime or diatomaceous earth, 4 parts; or calcium arsenite, 1 part, and hydrated lime or diatomaceous earth, 3 parts; to the bodies of the crickets. Application is made by the use of hand dust guns. The insects clean the poison from their feet and antennae with their mouth parts, thus obtaining sufficient to cause death. Dusting should be done as early as possible while the tiny young crickets are bunched, for then the area to be treated is much smaller than it will be later and less poison is required to kill the insects. Migrating bands are effectively killed at any time in the year by dusting them when they can be found bunched. Dusting the vanguard of a migrating band kills large numbers of them and often has the effect of turning their direction of march.

Mourning Cloak Butterfly. The large, spiny caterpillars are black, marked with white and red dots. They occur in groups and defoliate individual branches on cork elm, poplar trees, etc. They are rarely of much importance.

Control: Clip off and destroy infested branches, or if the infestation is severe, spray with lead arsenate, 3 pounds to 100 gallons of water, when the caterpillars make their appearance.

Narcissus Bulb Fly. The bulbs of narcissus and other plants fail to grow when attacked by the narcissus bulb fly. The bulbs become soft and the outer scales of the bulbs often have brown scars upon them. The large, whitish or yellowish-white maggots feed upon the plant tissues inside the bulb. The adult fly is a shiny, yellow-and-black, hairy fly about the size of a small bumble bee. The eggs are laid in the bases of the leaves or in the necks of the bulbs.

Control: Treat bulbs by submerging them in water held at a temperature of 110 to 111 degrees F. for 2½ hours. Infested bulbs may be sorted out and destroyed at the time of taking them

from the field. The bulbs may be treated by fumigation with paradichlorobenzene. The fumigant is placed in the bottom of an airtight box at the rate of 4 ounces per cubic foot of space in the box. The thoroughly dried bulbs may be arranged in trays in the box and left to fumigate about 6 days after which they should be removed and well aired.

Norway Maple Aphid. The Norway maple aphid is a rather large, hairy and yellowish-green aphid with brown markings. The eyes are reddish and the antennae are long and hairy. These aphids cluster in numbers along the veins of the undersides of the leaves. They secrete large quantities of honey-dew. In severe infestations the leaves develop brown blotches, become wrinkled and stunted, and eventually fall off.

Control: Thorough spraying with nicotine sulphate or pyrethrum extract, 1 pint to 100 gallons of water to which has been added 4 or 5 pounds of powdered soap will do much to check the aphids. Care should be taken to spray the undersides of the leaves.

Nose Botfly. The nose botfly is even more rapid in its movement than the throat fly. The female darts at the lip, deposits an egg, and then flies away, only to return in a few seconds to deposit another. The eggs are laid on or around the muzzle.

Control: Same as for horse botfly.

Oblique-Banded Leaf Roller. This insect is common in greenhouses. The tiny green larvae feed for a short time as miners in the leaf but later come to the lower surface. The adult moth is a little over an inch long, reddish-brown in color, with the front wings crossed by three distinct dark brown bands.

Control: Same as for greenhouse leaf tyer.

Onion Maggot. The small, grayish fly deposits her eggs on the onion plant. Larvae are small, legless maggots, nearly white in color, and when full-grown are about $\frac{3}{8}$ inch long. Maggots eat into the bulbs, causing them to die. Pupation takes place in the soil and winter is normally passed in the pupal stage. Maggots are able to survive the winter in onion bulbs left in the field or in cull piles. There are two generations annually.

Control: All bulbs, cull onions, etc., in the field should be destroyed after harvest. Probably the best method of control is to spray the onions with Bordeaux-oil emulsion, using $1\frac{1}{2}$ gallons of emulsion to 50 gallons of spray. The emulsion is prepared by boiling together 1 gallon of light grade lubricating oil with 2 pounds of fishoil soap and 1 quart of water. After the mixture has boiled for about 2 minutes, pump it through a spray pump twice while it is still hot.

Commercial dormant-type emulsion may be used in place of the home-prepared emulsion. Use the emulsion at the rate of 1 gallon per 50 gallons of 4-5-50 Bordeaux mixture, adding it to the spray tank while filling and while the agitator is running. Apply the mixture to the row so that the soil immediately around the plants is moistened using only sufficient pressure to break the liquid into a coarse spray. From 100 to 150 gallons per acre is sufficient. Application should be made as soon as plants appear above the ground, and should be repeated two or three times at intervals of 1 week.

Onion Thrips. Tiny yellow or brown insects that hide in "crotches" of the plants and in the soil in the daytime and feed on the plants at night or in cloudy weather. Injured leaves assume a silvery appearance and become crisp and dry.

Control: Dust the plants heavily with 3 per cent nicotine dust (see page 66 for preparation), or drench with 40 per cent nicotine sulphate, ¾ pint to 100 gallons of water, in which is first dissolved 6 pounds of potash fishoil soap; or with nicotine sulphate, ¾ pint added to a solution of 99 gallons of water and 1 gallon of summer-type oil emulsion. In spraying, use a rod or gun and cover every plant until the liquid runs into the crotches. Start applications as soon as the first thrips are observed on the plants (about June 1), and repeat applications at 10-day intervals until the danger of injury is past. Keeping the plants heavily dusted with hydrated lime or diatomaceous earth gives a relatively high degree of control.

Oyster-Shell Scale. These are tiny sucking insects that become fixed on the bark of fruit trees, and as they grow cover themselves with a brown secretion resembling an oyster shell in shape. There is only one generation each year. Eggs are deposited under the shell and hatch shortly after the apple trees bloom. The young insects soon fix themselves on the bark where they suck the sap. They appear as tiny yellow specks on the bark before they are covered with their secretion.

Control: Dormant-type oil emulsions used at the rate of 5 gallons to 95 gallons of water are preferable when infestations are severe. In lighter infestations lime-sulphur at the strength used for San Jose scale gives commercial control when used annually. The young may be killed by the application of summer-type oil emulsion used at the strength of 1½ gallons to 98½ gallons of water shortly after they hatch.

Pacific Mite. The Pacific mite is a pest of the apple in Idaho, but may occur rarely on prunes. This mite has been called the two-spotted mite or common red spider. The two-spotted mites and red spiders attacking other plants are different species. The

Pacific mite is a pale lemon-yellow in color, and has irregularly shaped dark spots on the back. It hibernates in the soil and migrates into the tree in the spring. Aside from its color and markings, it is recognized readily by the fact that it spins a dense web, especially on the under sides of the leaves, beneath which it feeds. Eggs and all forms of the mite are protected during the summer by this web. Injured leaves become dry and leathery, turn red or brown and often fall prematurely. The size and quality of the fruit is seriously impaired. The orchardist should carefully examine his trees every few days in the spring after the foliage is out and be prepared to spray as soon as the first mites are found on the leaves and before they have an opportunity to form heavy webbing. Since the mites make their way upward from the soil, the lower leaves are infested first, and the infestation spreads upward as the season advances.

Control: Spray the trees thoroughly with summer-type oil emulsion at the rate of 1 to 1½ gallons in 99 gallons of water. Avoid the use of dormant type oils since they are likely to cause injury to green leaves or young fruits. In spraying, pay particular attention to drenching the trunks, lower leaves, and under leaf surfaces. The oil spray for mite control may usually be added to one of the early codling moth sprays. Control is more difficult late in the season.

Painted Lady. The butterflies have a wing expanse of approximately 2 inches, the wings mottled with brown, orange, and white spots. The spiny caterpillars are dull brown or black with a pale yellow stripe on each side. They commonly feed on thistles and other weeds, but, when numerous, may be found on many cultivated crops.

Control: Spray with lead arsenate, 2 pounds in 50 gallons of water when the caterpillars appear. Control measures are seldom necessary.

Pea Aphid. Green plant lice occasionally become very numerous on first-crop alfalfa, and frequently on sweet peas and garden and field peas. They cause injury by sucking the sap from growing plants causing foliage and blossoms to wilt and shrivel. Severely injured plants turn yellow and dry up.

Control: For sweet peas and peas planted in rows, the best control known is to dust the plants heavily with nicotine dust, made by mixing together first 8 pounds of monohydrated copper sulphate and 38 pounds of hydrated lime, and then adding 4 pounds of 40 per cent nicotine sulphate and mixing again. All the mixing must be thoroughly done. Directions for mixing are given on page 66. Dusting must be done on a calm day when the temperature is 70°F. or higher. Spraying with 40 per cent nicotine sulphate at the rate of 1 pint and summer-type oil emulsion 1 gallon to 80

gallons of water, may be used instead of dusting, but it is less effective. First dilute the oil emulsion with the water and then add the nicotine sulphate. Indications are that a dust containing 1 per cent of rotenone, applied at the rate of 25 pounds per acre, will give satisfactory control.

When first-crop alfalfa is severely attacked, it should be closely clipped immediately and quickly removed from the field, and the field kept dry until after new growth starts. Granular calcium cyanide, 25 pounds per acre, sown on top of the ground in a grain drill, kills most of the aphids when alfalfa plants are small, but its use is impracticable except in extreme cases.

Clipping the alfalfa very close late in the fall or grazing it after the last crop is cut prevents heavy infestations from developing.

Pea Weevil. This small gray-brown beetle lays its eggs on the outsides of the pods. Grubs eat into the peas where they mature and pupate. Most of the adults emerge from the peas in the fall, but some of them remain in the seeds until the following spring. Weevily peas are readily recognized by the large, circular emergence holes. Adults fly long distances, some of them hibernate in trash in the field, in old pea vines, in cracks in fence posts, under bark of posts, trees, etc. There is one generation annually.

Control: Garden peas may be almost completely protected from weevils by dusting them with rotenone dust containing not less than ¾ of 1 per cent of rotenone. This dust kills only the adults and has no effect on the eggs. It is not effective for longer than 24 hours after it is applied; and, as adult weevils move to peas from hibernating quarters over a considerable period of time, four or five successive applications must be made at 4- or 5-day intervals.

Weevils may also be controlled on field seed and canning peas by the use of rotenone dust. Further information on the control of weevils on large acreages may be obtained by writing to the Idaho Agricultural Experiment Station.

Peach Borer. The clear-winged moths deposit their eggs on the trunk of peach and prune trees near the ground. When larvae hatch, they make their way into the trunk just below the soil surface. They feed and grow in the trunk or roots beneath the ground, frequently completely girdling and killing the trees. Masses of semi-transparent gum exude from holes made by the larvae. Larvae are very light yellow, have a light brown head, and when mature are about 1 inch long. There is one generation annually.

Control: Smooth the ground around the base of the tree, lowering the level as little as possible. Spread a narrow ring of paradichlorobenzene entirely around, about 2 inches away from the

trunk, cover with 4 inches of soil and pat down. Use ½ ounce of paradichlorobenzene for young trees; ¾ ounce to 1 ounce for trees 5 years old or older. The best results are obtained by making the application about September 15, after most of the eggs have been laid. Mounds should be leveled down to the general soil surface the following spring to prevent moths from laying their eggs high on the tree trunks. Applications may be made in the spring if the borers are causing severe injury and it is necessary to obtain protection, but fall applications make it unnecessary to apply spring control and eliminate the injury caused by overwintering borers.

Treatment should not be made when the soil temperature is likely to fall below 60°F. for the first 2 weeks after application. Infestations in the trunk and crotches may be treated by painting the affected parts with a solution of 1 pound of paradichlorobenzene in 2 quarts of cottonseed oil.

Ethylene dichloride also gives excellent control. Stock emulsion is prepared by adding 9 gallons of ethylene dichloride to 1 gallon of potash fishoil soap, emulsifying, then adding water to make 18 gallons. This stock emulsion is diluted before use with water according to the age of the tree. Use 3 volumes of the stock emulsion to 7 of water, ¼ to ½ pint for 2- to 3-year-old trees; 2 volumes of stock to 3 of water, ½ pint for 4- to 5-year-old trees; and ½ pint of a half and half mixture for older trees. Apply by wetting the soil immediately surrounding the tree. The lower part of the trunk should receive some material during treatment.

Peach Lecanium. This brown, hemispherical scale adheres to the smaller branches. The insect under the scale sucks the sap and devitalizes the trees. This insect is of relatively little importance in Idaho.

Control: This insect is readily controlled by the dormant oil emulsion or lime-sulphur sprays used in the control of San Jose scale.

Peach Twig Borer. These are uniformly brown-colored larvae with a black head; the first segment of the body is black. The mature larva is slightly less than ½ inch long and has the appearance of having light and brown stripes alternating cross-wise of the body. There are two generations annually. The overwintering generation hibernates beneath the bark in the crotches of the branches and emerges about the time peaches bloom. These larvae attack the terminal twigs, killing and deforming them. A second generation bores into the fruits and is the principal cause of "wormy" peaches.

Control: Spray with lime-sulphur as for San Jose scale. Oil sprays are not effective. Lead arsenate, 4 pounds to 100 gallons

of water, sometimes gives a high degree of control if applied just as larvae emerge in the spring, but it is difficult to time the application correctly and poor control often results.

Pear Leaf Blister Mite. These nearly microscopic, pink-colored mites live beneath the bud scales of apple and pear during the winter. They emerge early in the spring and begin feeding inside the leaves before they are fully opened. They cause little blisters which are at first light green or red but which later turn to rusty brown. In late summer severely infested leaves are red and dry in appearance, and whole areas in the leaves are killed. Injured fruits are misshapen, rough, and russeted. Many generations develop in a season all of them within the leaf tissue where they are not successfully reached by sprays.

Control: This mite is readily controlled any time during the dormant season with lime-sulphur spray testing 3½° Baume. Spraying should be done before the leaves begin to unfold.

Pear Psylla. The pear psylla recently has been introduced into the Pacific Northwest, and until this introduction, it was known only east of the Mississippi river. The adults are dark, reddish-brown, four-winged insects about 1/10 inch long. The nymphs are much smaller, very broad, active, and yellow, and are found on the fruit and leaves during the growing season. The adult psylla overwinter under the bark of trees or in other sheltered places about the orchard. The insect attacks pear and quince. The leaves on heavily infested trees turn brown and often drop; the fruit drops prematurely or is undersized and of poor quality. Both the leaves and fruit of badly infested trees will be covered with honeydew, which is generally covered with a black fungus later in the season.

Control: Spray thoroughly with oil emulsion or miscible-oil sprays applied at strengths as for San Jose scale. Spraying should be done when the leaves fall, or just before growth starts in the spring. Trees may be thoroughly sprayed with dormant lime-sulphur, applied just before the blossom buds open. During the summer, spray with Bordeaux mixture (2-3-50) and ½ pint of 40 per cent nicotine sulphate to each 50 gallons.

Pear Slug. Sticky, shiny, olive-green or nearly black larvae move little and destroy the upper leaf surface, causing leaves to turn brown and become crisp. One generation attacks the foliage in the early spring and another in the fall.

Control: Spray with calcium arsenate, 2 pounds to 100 gallons of water, or dust the foliage lightly with calcium arsenate or hydrated lime. One application in the spring, as soon as injury begins to be noticeable, is sufficient. Another application in the fall may

be necessary for control of the second brood. A dust containing 1 per cent rotenone is also effective.

Pine Needle Scale. Needles of pines sometimes are dotted with white specks. These are the scaly coverings of tender-bodied sucking insects. The purplish eggs of the insects may be found beneath the scales in the winter. The young appear some time in May and are red. They may be readily observed crawling about on the needles.

Control: Spray the infested trees with summer-type oil emulsion, 2 gallons to 98 gallons of water, about 10 days after the first crawlers are observed. This will be about the last of May or the first of June. Oil sprays should not be applied to coniferous trees more than 1 year in 4.

Prune Leafhopper. Severe injury is caused to the foliage of prune by the feeding of both the young and adult forms of a white-colored leafhopper. This species has two generations a year and passes the winter in the egg stage under the bark on the smaller branches and twigs. Injured leaves lose their green color, become dry, and are covered with tiny, light-colored flecks. The injury results from the insect sucking the sap out of the leaf tissue.

Control: It is not difficult to obtain good control but spraying must be done when the nymphs of the first generation are present on the foliage. This is usually about the first week in June. At that time they are readily controlled by the use of summer-type oil emulsion at the rate of 1 gallon in 100 gallons of water. After the nymphs change to the adult or winged stage, they are difficult to kill, and it is necessary to add nicotine sulphate or pyrethrum extract at the rate of 1 pint to 100 gallons of the oil-emulsion spray.

Prune-Thistle Aphid. These red or green plant lice curl the leaves of plums and prunes in the early spring and form sticky honey-dew. Heavy infestations are extremely injurious and cause a heavy drop of small prunes.

Control: Infestations are of little economic importance in orchards where a dormant oil spray is applied early in March for San Jose scale. After the foliage is out, spray with nicotine sulphate, 1 pint, and 1 gallon summer-type oil emulsion in 99 gallons of water. Make applications just as the leaves are appearing and before curling of the leaves takes place.

Psoroptic Mange Mite. The mites which cause psoroptic mange of horses live on the surface of the skin and do not form burrows. These mites are slightly larger than scaroptic mites. Psoroptic

mange may start on any part of the body which is thickly covered with hair, but the first lesions usually appear on the head under the foretop, on the top of the neck around the mane, or on the rump. The disease may spread over the entire body. The mites prick the skin and probably introduce a poisonous secretion into the wound. A slight irritation is caused, accompanied with severe itching. As the mites multiply, large numbers of small wounds are made in the skin, followed by the formation of papules, increased inflammation and itching, and the exudation of serum. The serum soon becomes mixed with foreign material and microorganisms, and a hardened yellowish or gray-colored scab forms. The skin becomes thickened and wrinkled as the infection increases; large areas become denuded of hair and covered with thick scabs.

Control: The psoroptic mange mite is more easily controlled than the scaroptic mange mite, because it lives on the surface of the skin. The same remedies are recommended for both mites. (See page 49).

Raspberry Cane Maggot. Young canes from 1 to 3 feet in length are attacked by this insect. The canes suddenly wilt and have a purple discoloration appearing at the point of attack. The maggot enters the cane, bores downward a few inches and then completely girdles the shoot.

Control: Remove and burn all of the injured canes as soon as observed in the spring to protect next year's young shoots.

Raspberry Fruit Worm. Adult beetles, which are light brown in color and approximately ⅛ inch long, appear early in the spring and feed on the young leaves and newly opened buds at the tips of the canes. The small brown and white grubs, hatching from these eggs, bore into and feed upon the berries making them unfit for food. When full-grown the grubs are approximately ¼ inch long.

Control: Three applications of a 1 per cent rotenone dust at weekly intervals, beginning 10 days after the first blossoms appear, give good control. Two pounds of derris or cube, containing 5 per cent rotenone, in 100 gallons of water, may be used as a spray.

Raspberry Root Borer. The adult is a clear-winged moth with a black body crossed by four narrow yellow bands. Eggs are deposited on the under sides of the leaves and larvae hatching from them make their way beneath the bark just below the ground level or under flakes of bark at the bases of stems. The following spring they tunnel beneath the bark of stems and roots, often girdling them and causing wilting stems or dying plants. They continue to grow until the next spring when they are nearly 1 inch long. They pupate in their tunnels. The life cycle is 2 years.

Control: Treat each plant by placing a pound of mixture of equal parts of fine tobacco dust and hydrated lime about the crown and roots of each plant. Make a hollow by mounding the soil up around the edges of the pile of dust and pour over the dust a quart of water. After the water has soaked, draw the earth into a mound around the base of the plant. This mixture kills the young larvae and should be applied after the first of October.

Raspberry Sawfly. The lower leaves are skeletonized in June by spiny green "slugs" which hatch from eggs laid in the late spring in rows in small punctures in the undersides of the leaves. They move from shoot to shoot or plant to plant as defoliation becomes complete. The adult passes the winter in the soil.

Control: Spray with calcium arsenate 2 ounces, hydrated lime 8 ounces, and water 3 gallons just before the blossoms appear, or dust with a dust containing 1 per cent rotenone after the blossoms have appeared.

Red Spider (Common). The common red spider in Idaho includes more than one species and they have not yet been fully described. The one occurring on apple has been found to be the Pacific mite, while one similar in general appearance found infesting red clover in 1939 proved to be a new and undescribed species. The common red spiders vary in color from lemon yellow to a yellowish green and usually have two irregular dark spots on the back so that they are often spoken of as two-spotted mites. During the migration period the mites become red or orange. The common red spider winters in the soil as an adult and migrates to the growing plants in the early spring. It attacks many kinds of fruit trees, bush fruits, field crops, and ornamentals. It is readily recognized by the dense webbing it spins on the leaves, especially on the undersides. It feeds beneath the web which also protects the eggs and young forms. There are several generations annually. Injured leaves become dry and leathery, turn red or brown in color, and often fall prematurely. Severe damage to the plant or crop may be done in a very short time.

Control: Spray thoroughly with summer-type oil emulsion at the rate of 1 to 1½ gallons in 99 gallons of water. Avoid the use of dormant type oils since they are likely to cause injury to leaves or young fruits. Probably the best means of controlling red spiders on field crops, such as beans, clover, potatoes, etc., is by dusting the infested plants with dusting sulphur at the rate of 25 pounds per acre.

Rose Aphid. This pink- or green-colored plant louse frequently covers stems, buds, and young leaves, and secretes a sticky honey-

dew. It frequently severely injures plants by sucking the sap. There are many generations annually.

Control: Spray with 40 per cent nicotine sulphate, or pyrethrum extract, 1 teaspoonful to 1 gallon of water, in which is first dissolved a piece of soap the size of a large walnut. It is important to make applications as soon as the first aphids appear. Applications should be repeated as often as necessary.

Rose Curculio. This red, snout-beetle is about ½ inch long. It causes injury by puncturing the flower buds so that the petals, when they unfold, are riddled with holes.

Control: Hand pick the beetles on or beneath the plants. Spray with Bordeaux mixture 6-6-50 to repel the beetles, making the first application when the first flower buds are developing. Keep the new buds covered with spray as they form.

(Rose) Leafhopper. This slender, sucking insect is only about ⅛ inch long. It is greenish-yellow or pale yellow. Injured leaves are identified by the flecking and mottling which occurs around the leaf punctures. Severely infested leaves become crisp and dry. The young are wingless, very delicate creatures, and are found on the under surfaces of the leaves. Injury is caused by both adults and young.

Control: Follow the recommendations for Virginia Creeper leafhopper. Leafhoppers migrate from non-sprayed plants, and it is usually necessary to repeat spray applications frequently to keep rose bushes in good appearance.

Rose Scale. Snow-white, nearly circular scales are found on the canes. This insect is rarely injurious.

Control: Spray with lime-sulphur, 1 gallon to 10 gallons of water, during the dormant season.

Rose Slug. Slimy, green, slug-like worms feed upon the leaves, skeletonizing them. Infested leaves turn brown, as though severely burned. The adult is a shiny black sawfly, slightly larger in size than the common housefly.

Control: Spray or dust with pyrethrum or rotenone when the slugs are seen, either in early spring or late fall. Calcium arsenate dust or spray is also effective.

Rosy Apple Aphid. Pink or purplish plant lice roll apple leaves severely and cause dwarfed, misshapen fruits. Their attack is not restricted entirely to the new leaves and tender growth. Several generations develop in the spring. The winter is passed

in the egg stage on the bark of apple trees. Eggs hatch in the spring about the time that buds begin to swell.

Control: The rosy apple aphid must be controlled early in the spring before the leaves begin to curl. Some degree of control is obtained by the use of the regular dormant spray of oil emulsion or lime-sulphur as for San Jose scale if the application is made just before the buds burst. Better control results if 40 per cent nicotine sulphate is used at the rate of 1 pint in 100 gallons of either the oil emulsion or lime-sulphur spray solutions.

Rust Mite. The rust mite is so extremely small that it scarcely can be seen with the naked eye. Where the infestation is heavy, as many as four to five thousand mites have been counted on a single leaf. The injury from the mites causes the leaves to curl lengthwise. After severe injury early in the season and prolonged hot weather in July and August, the foliage becomes dry and crisp and turns brown. Mite-injured trees have the appearance of suffering from drought. This foliage injury causes sunburn, and a reduction of the size and quality of the fruit. The mites feed during the spring and early summer, and disappear soon after the first high temperatures in July. It is usually at about this time that injury becomes evident, and it is then too late to spray for control.

Control: Control measures for the rust mite to be effective should be applied before June first, using a summer-type oil emulsion spray at 1 per cent oil strength.

San Jose Scale. These are tiny yellow insects that fix themselves on the bark or fruit of many kinds of fruit trees, shade trees, bush fruits, and ornamentals. They increase rapidly and kill the plants by sucking the sap. As the tiny insects grow, they cover themselves with an ash-gray secretion or scale nearly circular in outline. There are several generations each year.

Control: San Jose scale is controlled by oil-emulsion sprays, using dormant-type oil emulsion at the rate of 4 gallons to 96 gallons of water, or by lime-sulphur at the rate of 10 to 12 gallons of liquid lime sulphur (testing 32° Baume) for each 100 gallons of spray solution. Home-made lime-sulphur should be diluted to test from 4° to 5° Baume in the spray tank. Spray while plants are completely dormant. Five pounds of dry lime-sulphur is equivalent chemically to 1 gallon of 32° liquid lime-sulphur.

Saw-Toothed Grain Beetle. This beetle is a common household pest. It is reddish brown, about ⅛ inch long, and derives its name from the notched fringe on each side of the body. The grub is yellowish white and marked on each segment of the body by a darkened area.

Control: The most practical means of protection is to keep all containers free of particles of grain, flour, etc., being sure that each time a new supply is placed in them that they are first cleaned out. Precaution should be taken that flour or other grain products do not collect beneath bins. A practical safeguard is to keep flour in the bag in the bin and keep the top of the bag rolled shut tightly. The insects cannot gain access through tightly woven sacking cloth. An additional safeguard is to keep sodium fluoride sprinkled beneath bins and pantry shelves. When it is necessary to clean up an infestation in the house, infested foods should be destroyed or heated for a period long enough to insure their reaching a temperature of 140° F. This may be done by placing them in the oven. Bins, drawers, etc., may be washed with scalding hot water and then dried, or they may be heated over a stove or in an oven. Clean-up measures are satisfactory also in the case of grain bins, storage elevators, etc. They should be first thoroughly cleaned and scrubbed out and the cracks sprayed with gasoline or kerosene in time so these substances may evaporate before grain is stored in them again. Fumigation is sometimes necessary, but it can be used only in unoccupied buildings that are relatively air tight. Those wishing to fumigate should write the Idaho Agricultural Experiment Station for special instructions.

Scab Mite. The scab mite causes one of the most injurious and contagious of sheep diseases. It is a psoroptic mite that lives on the outside of the skin similar to the psoroptic mite of the horse. These mites cause the common sheep scab.

Control: They are controlled by dipping the sheep in warm lime-sulphur or nicotine dip from 3 to 5 minutes. Follow the directions for dilution given by the manufacturer. The treatment should be repeated one or two times at 10- to 14-day intervals. Sheds and other buildings in which sheep are housed should be cleaned and sprayed with a 5 per cent carbolic acid or lime-sulphur or creosote dip. The animals should be changed to fresh pasture.

Scaly Leg Mite. Scaly leg is caused by small mites burrowing into the skin on the legs and feet of poultry.

Control: Dip feet of affected birds in crude petroleum or used crank case oil. Repeat treatment in about a month if necessary.

Scaroptic Mange Mite. The mites which cause scaroptic or common mange of horses are small white, or yellowish parasites. The adults will measure about 1/50 or 1/60 of an inch in length. They are not readily visible to the naked eye unless placed on a black background. The general form of the body is more nearly round than oval and the bluntly rounded head is as broad as it is long. The mites penetrate the upper layer of the skin and excavate

burrows in which eggs are laid. The young mites feed in the burrow and when mature begin new burrows and lay more eggs. In the early stages of this type of mange, lesions are first visible on the neck and shoulders or around the head, but they may start on the breast, flanks, sides or other parts of the trunk. From those parts the mange may spread until it covers the entire body. The presence of the mites causes itching and great irritation and the skin becomes inflamed and swollen so that small nodules are formed around and over the burrows. Later, vesicles are formed which break and discharge serum and as the serum dries small scabs are formed. The hair over the affected part stands erect or may fall out. As the disease develops the skin becomes more or less bare in irregular-shaped patches, and is generally thickened and thrown into folds.

Control: This mite is extremely difficult to eradicate because of its burrowing habit. The common dips such as lime-sulphur, nicotine, and coal-tar creosote will kill scaroptic mites if the dip can be brought into direct contact with the parasites, but the method requires thorough, frequent, and persistent application. Dilutions should be made according to the directions given by the manufacturer. Two or more applications, a week apart, of unprocessed crude petroleum usually will eradicate scaroptic mange if treatment is applied before the disease becomes chronic. Crude oils, however, often cause the hair to come out and may blister the skin. Crank case oil drainings may be substituted for the crude oil but it will also blister and cause the hair to come out.

Seedcorn Maggot. These cream-colored maggots are found in potato seed pieces and seed beans in the soil, particularly during cold, wet springs. They frequently injure planted beans, killing the plants entirely or causing light stands or a condition known as "baldhead."

Control: No direct control method is known. The flies which lay their eggs on the soil are known to be attracted by the presence of freshly decaying organic matter. In fields where potatoes are to be grown, it is best to turn under in the autumn the manure or green cover to be used as fertilizer rather than to do it in the spring before planting. Satisfactory stands and fields are obtained by replanting infested fields as soon as it is determined the first planting will be unproductive. By that time most of the maggots have developed and the second planting usually remains free of injury. Sometimes it is practicable to plant a field to beans a little earlier than the usual planting date, and then in about 10 days, rework the field and plant the main crop.

Sheep Botfly. Sheep shake their heads, stamp their feet, and crowd together, holding their noses to the ground, especially in bare dusty places; or run away with their noses held low, in

an effort to escape the fly which deposits its larvae in the nostrils of the sheep. The presence of the larvae in the nostrils causes inflammation, and a copius catarrhal discharge. The excess of mucus together with the dust drawn into the nostrils causes labored breathing. The presence of the maggots in the head may cause thinness and weakness in the animals.

Control: The bedding-out method of range sheep management followed in Idaho leave the larvae behind and is responsible for the practical absence of nose grubs in range sheep in this State. Perhaps the best method found to date for the treatment of grubs-in-the-head in farm sheep is the application of about ½ teaspoonful of a mixture of equal parts of carbon disulphide and a light mineral oil introduced into each nostril of an infested sheep. This is of decided value in killing the larvae in the sinuses of the head. The success of this method depends wholly on getting some of the solution into the infested sinuses. This can be accomplished best by laying the sheep on one side and partly turning the head over in such a way that the solution injected onto the upper surface of the nostril will run into the sinuses.

Sheep Lice. Three species of lice attack sheep; the bloodsucking louse, the bloodsucking foot louse, and the red-headed or chewing louse of sheep. The usual symptoms of scratching and biting are caused by the lice running about in the wool and over the skin. The chewing lice eat the wool fibers, the bloodsucking lice rob the sheep of nutrition and stain the wool with small brown fecal spots.

Control: These lice are best controlled on sheep by dipping the animals in nicotine, sulphur or creosote dips, giving two treatments at intervals of 2 weeks. The dilution recommended by the manufacturer of the dip should be used. The red-headed lice may be controlled by dusting sodium fluoride into the wool over the entire animal. About 1 ounce is sufficient for each sheep. Sucking lice may be controlled in winter by dusting pyrethrum or derris powders into the wool. Shallow dipping or washing of the legs in nicotine, sulphur or creosote dips should be sufficient for the foot louse, and this can be done at any season.

Sheep Tick. The sheep tick, louse, fly, or ked, as it is sometimes called, is not a true tick but an insect. It is a degenerate fly which has lost its wings. It feeds by crawling about over the wool and thrusting its sharp mouth-parts into the flesh to suck blood. It causes the sheep to rub, bite, and scratch at the wool, thus spoiling the fleece; and, when abundant, the animals are unthrifty and unprofitable. The sheep tick spends its entire life on the animal. Two stages are readily found on the sheep at all seasons of the year; the adults and the nits. The adult is brown, wingless, about ¼ inch long and is covered with short, spiny hairs. Nits are

nearly round, chestnut brown, egg-like objects that are glued to the hair especially about the neck, inside the thighs and along the belly. These are the pupal stage of the insect, not eggs.

Control: The best method of control is to dip the sheep in the fall with one of the coal-tar creosote dips according to the directions of the manufacturer. The dips do not kill the nits and the second dip must be applied to control the newly emerged adults before more nits develop.

Short-Nosed and Long-Nosed Cattle Lice. These lice are both common pests of cattle and may be considered together since their habits and control are very similar. Both of these lice are bluish gray in color. They may be found on the lower parts of the body of the cow, between the legs, on the belly, and on the escutcheon. They injure cattle by sucking blood. These lice do not migrate much on the body of the animals, but usually stay in one small area after they have found a suitable feeding place. Severe infestations cause cows to lose weight and fall off in milk production. Irritation from the lice causes the animals to attempt to rub and bite the affected parts, resulting in hair removal and, in severe cases, broken skin and scab formation.

Control: Both of these lice may be controlled by a small amount of raw linseed oil applied with a grooming brush, or by applications of sodium fluoride or rotenone dust, as previously described for the horse biting-louse. The dusts will not kill the eggs and repeated applications are sometimes necessary. The ordinary coal-tar dips also kill the lice.

Shot-Hole Borer. The shot-hole borer is sometimes found working in prune, peach, and apricot trees, especially in years following widespread frost injury to trees. During the winter this borer is in the grub or larval stage in the inner bark. The overwintering grub is about ⅛ inch long, pinkish white in color. They change to pupae in the spring and a little later the adult beetles emerge. The beetles are 1/10 inch long, half as wide, very blunt at either end, and black in color. On emerging, the beetles seek out trees in an unhealthy condition in which to lay their eggs. The bark of infested trees is perforated with numerous small "shot-hole" openings from which the insect gets its name. Beneath the bark are found many small, winding, sawdust-filled galleries that usually girdle the infested part. Death of the branch or tree follows an infestation, but beetles rarely are the primary cause of the death of a tree. This insect almost invariably confines its attacks to diseased and dying trees, or trees in a poor state of vigor.

Control: No satisfactory method of treating an infestation in a tree is known, but it is advisable to prune out all infested branches, as well as all diseased and dead wood, and burn it. Cul-

tural practices should be resorted to in order to get trees into vigorous growing condition.

Snowball Aphid. These are bluish plant lice that attack the leaves early in the spring, causing curled, deformed leaves, and small, inferior blossoms. Winter is passed in the egg stage. Newly hatched aphids attack the terminal leaves early in the spring. Injury is all caused early, for aphids fly away later and do not return to the snowball until autumn.

Control: Spray snowball bushes when the leaves first show green, using 40 per cent nicotine sulphate 1 teaspoon, commercial oil emulsion 20 teaspoons, and water 1 gallon; or spray with nicotine sulphate or pyrethrum extract, 1 teaspoon in 1 gallon of water, in which has been dissolved a piece of soap the size of a large walnut.

Snowy Tree Cricket. These green or yellowish "crickets" occur most numerously on prune trees. Eggs are deposited in the bark on the undersides of medium-sized branches in the fall. They hatch about June 1. Feeding is generally confined to the leaves until about July 25 or when the first prunes begin to show color. Crickets then attack the fruit, eating holes of various sizes into it. The first adults develop about the middle of July, after which time males may be heard chirping in unison in infested trees. There is one generation annually.

Control: Dust the trees with undiluted calcium arsenate at the rate of about 0.14 pounds per tree or spray with calcium arsenate, 2 pounds to 100 gallons of water. A spreader should be used with sprays to prevent spotting the fruit. Application should be made between July 15 and August 1. One application completely protects the fruit and so reduces the population that spraying is not necessary again for several years.

Sowbugs. These grayish, fat-bodied, fringed, slow-moving creatures attain a length of about ½ inch. They may be found near the ground under trash, leaves, or bits of manure. They cause injury by feeding on tender stems or leaves near the ground.

Control: They are controlled by means of a poisoned bait. The formula suggested on page 66 may be used, but 4 gallons of molasses per hundredweight should be added and the bait made rather sloppy. Another bait is prepared by mixing 1 part of Paris green with 9 parts of granulated sugar. This bait is sprinkled lightly along the edges of benches and walks.

Spinach Leaf Miner. White or yellowish maggots mine within the leaves of spinach, beets, chard, and many weeds, causing blasted spots or blister-like blotches. The grayish, two-winged

flies of the maggot appear in the field in April or May, and may be found throughout the season.

Control: There is no practicable method of control for this insect.

Squash Bug. Adult squash bugs are pale or dark grayish brown on the back, and the protruding margins of the abdomen are orange or alternately striped with orange and brown. The length of the body is about ⅝ inch. Eggs are whitish yellow to brown and are laid in clusters on the under sides of the leaves. The young are pink to gray and are often covered with a whitish powder. Both adults and young suck the sap and cause plants to wilt or die.

Control: The best means of reducing infestations is to burn all refuse in the fall under which the insects are hibernating. Place small strips or boards on the ground both before and after the crop is planted, and early in the morning, while the bugs are sluggish, destroy the bugs collected under the boards by dropping them into kerosene. Hand pick and destroy adults on the plants. Hand picking of nymphs and eggs is quite effective in small areas. Young nymphs may be killed by spraying them with nicotine sulphate or pyrethrum extract, 2½ teaspoons to 1 gallon of water, in which has been dissolved a piece of soap the size of a large walnut.

Stable Fly. Stable flies, to the casual observer, appear to be very much like the common house fly, but in reality they are quite different in that they feed by piercing the skin of their host to suck blood. They attack many animals, including man. They annoy the animals by their biting. This insect breeds in manure as does the common house fly.

Control: Since the flies breed in manure which is moist the control suggested is the disposal of the manure often during the fly season by distributing it on the fields where it will dry out quickly, thus preventing the adults from depositing eggs. Animals may be protected temporarily by the use of fly sprays applied to the animals themselves. Flies found about the barns may be killed with fly sprays.

Stone Fly. This species is black colored with red and yellow markings and measures between ½ inch and ¾ inch long. Larvae live in streams and emerge in the early spring leaving their cast skins on rocks and bushes. Occasionally the flies make their way to apricot and peach trees and cause severe injury by eating holes in the forming fruits and into the fruit buds.

Control: Control probably can be obtained by spraying the trees with lead arsenate as soon as the insects appear on the trees.

Strawberry Crown Moth. Adults are black, clear-winged moths varying in length from about ½ inch to ¾ inch. They are marked

dew. It frequently severely injures plants by sucking the sap. There are many generations annually.

Control: Spray with 40 per cent nicotine sulphate, or pyrethrum extract, 1 teaspoonful to 1 gallon of water, in which is first dissolved a piece of soap the size of a large walnut. It is important to make applications as soon as the first aphids appear. Applications should be repeated as often as necessary.

Rose Curculio. This red, snout-beetle is about ½ inch long. It causes injury by puncturing the flower buds so that the petals, when they unfold, are riddled with holes.

Control: Hand pick the beetles on or beneath the plants. Spray with Bordeaux mixture 6-6-50 to repel the beetles, making the first application when the first flower buds are developing. Keep the new buds covered with spray as they form.

(Rose) Leafhopper. This slender, sucking insect is only about ⅛ inch long. It is greenish-yellow or pale yellow. Injured leaves are identified by the flecking and mottling which occurs around the leaf punctures. Severely infested leaves become crisp and dry. The young are wingless, very delicate creatures, and are found on the under surfaces of the leaves. Injury is caused by both adults and young.

Control: Follow the recommendations for Virginia Creeper leafhopper. Leafhoppers migrate from non-sprayed plants, and it is usually necessary to repeat spray applications frequently to keep rose bushes in good appearance.

Rose Scale. Snow-white, nearly circular scales are found on the canes. This insect is rarely injurious.

Control: Spray with lime-sulphur, 1 gallon to 10 gallons of water, during the dormant season.

Rose Slug. Slimy, green, slug-like worms feed upon the leaves, skeletonizing them. Infested leaves turn brown, as though severely burned. The adult is a shiny black sawfly, slightly larger in size than the common housefly.

Control: Spray or dust with pyrethrum or rotenone when the slugs are seen, either in early spring or late fall. Calcium arsenate dust or spray is also effective.

Rosy Apple Aphid. Pink or purplish plant lice roll apple leaves severely and cause dwarfed, misshapen fruits. Their attack is not restricted entirely to the new leaves and tender growth. Several generations develop in the spring. The winter is passed

in the egg stage on the bark of apple trees. Eggs hatch in the spring about the time that buds begin to swell.

Control: The rosy apple aphid must be controlled early in the spring before the leaves begin to curl. Some degree of control is obtained by the use of the regular dormant spray of oil emulsion or lime-sulphur as for San Jose scale if the application is made just before the buds burst. Better control results if 40 per cent nicotine sulphate is used at the rate of 1 pint in 100 gallons of either the oil emulsion or lime-sulphur spray solutions.

Rust Mite. The rust mite is so extremely small that it scarcely can be seen with the naked eye. Where the infestation is heavy, as many as four to five thousand mites have been counted on a single leaf. The injury from the mites causes the leaves to curl lengthwise. After severe injury early in the season and prolonged hot weather in July and August, the foliage becomes dry and crisp and turns brown. Mite-injured trees have the appearance of suffering from drought. This foliage injury causes sunburn, and a reduction of the size and quality of the fruit. The mites feed during the spring and early summer, and disappear soon after the first high temperatures in July. It is usually at about this time that injury becomes evident, and it is then too late to spray for control.

Control: Control measures for the rust mite to be effective should be applied before June first, using a summer-type oil emulsion spray at 1 per cent oil strength.

San Jose Scale. These are tiny yellow insects that fix themselves on the bark or fruit of many kinds of fruit trees, shade trees, bush fruits, and ornamentals. They increase rapidly and kill the plants by sucking the sap. As the tiny insects grow, they cover themselves with an ash-gray secretion or scale nearly circular in outline. There are several generations each year.

Control: San Jose scale is controlled by oil-emulsion sprays, using dormant-type oil emulsion at the rate of 4 gallons to 96 gallons of water, or by lime-sulphur at the rate of 10 to 12 gallons of liquid lime sulphur (testing 32° Baume) for each 100 gallons of spray solution. Home-made lime-sulphur should be diluted to test from 4° to 5° Baume in the spray tank. Spray while plants are completely dormant. Five pounds of dry lime-sulphur is equivalent chemically to 1 gallon of 32° liquid lime-sulphur.

Saw-Toothed Grain Beetle. This beetle is a common household pest. It is reddish brown, about ⅛ inch long, and derives its name from the notched fringe on each side of the body. The grub is yellowish white and marked on each segment of the body by a darkened area.

Control: The most practical means of protection is to keep all containers free of particles of grain, flour, etc., being sure that each time a new supply is placed in them that they are first cleaned out. Precaution should be taken that flour or other grain products do not collect beneath bins. A practical safeguard is to keep flour in the bag in the bin and keep the top of the bag rolled shut tightly. The insects cannot gain access through tightly woven sacking cloth. An additional safeguard is to keep sodium fluoride sprinkled beneath bins and pantry shelves. When it is necessary to clean up an infestation in the house, infested foods should be destroyed or heated for a period long enough to insure their reaching a temperature of 140° F. This may be done by placing them in the oven. Bins, drawers, etc., may be washed with scalding hot water and then dried, or they may be heated over a stove or in an oven. Clean-up measures are satisfactory also in the case of grain bins, storage elevators, etc. They should be first thoroughly cleaned and scrubbed out and the cracks sprayed with gasoline or kerosene in time so these substances may evaporate before grain is stored in them again. Fumigation is sometimes necessary, but it can be used only in unoccupied buildings that are relatively air tight. Those wishing to fumigate should write the Idaho Agricultural Experiment Station for special instructions.

Scab Mite. The scab mite causes one of the most injurious and contagious of sheep diseases. It is a psoroptic mite that lives on the outside of the skin similar to the psoroptic mite of the horse. These mites cause the common sheep scab.

Control: They are controlled by dipping the sheep in warm lime-sulphur or nicotine dip from 3 to 5 minutes. Follow the directions for dilution given by the manufacturer. The treatment should be repeated one or two times at 10- to 14-day intervals. Sheds and other buildings in which sheep are housed should be cleaned and sprayed with a 5 per cent carbolic acid or lime-sulphur or creosote dip. The animals should be changed to fresh pasture.

Scaly Leg Mite. Scaly leg is caused by small mites burrowing into the skin on the legs and feet of poultry.

Control: Dip feet of affected birds in crude petroleum or used crank case oil. Repeat treatment in about a month if necessary.

Scaroptic Mange Mite. The mites which cause scaroptic or common mange of horses are small white, or yellowish parasites. The adults will measure about 1/50 or 1/60 of an inch in length. They are not readily visible to the naked eye unless placed on a black background. The general form of the body is more nearly round than oval and the bluntly rounded head is as broad as it is long. The mites penetrate the upper layer of the skin and excavate

burrows in which eggs are laid. The young mites feed in the burrow and when mature begin new burrows and lay more eggs. In the early stages of this type of mange, lesions are first visible on the neck and shoulders or around the head, but they may start on the breast, flanks, sides or other parts of the trunk. From those parts the mange may spread until it covers the entire body. The presence of the mites causes itching and great irritation and the skin becomes inflamed and swollen so that small nodules are formed around and over the burrows. Later, vesicles are formed which break and discharge serum and as the serum dries small scabs are formed. The hair over the affected part stands erect or may fall out. As the disease develops the skin becomes more or less bare in irregular-shaped patches, and is generally thickened and thrown into folds.

Control: This mite is extremely difficult to eradicate because of its burrowing habit. The common dips such as lime-sulphur, nicotine, and coal-tar creosote will kill scaroptic mites if the dip can be brought into direct contact with the parasites, but the method requires thorough, frequent, and persistent application. Dilutions should be made according to the directions given by the manufacturer. Two or more applications, a week apart, of unprocessed crude petroleum usually will eradicate scaroptic mange if treatment is applied before the disease becomes chronic. Crude oils, however, often cause the hair to come out and may blister the skin. Crank case oil drainings may be substituted for the crude oil but it will also blister and cause the hair to come out.

Seedcorn Maggot. These cream-colored maggots are found in potato seed pieces and seed beans in the soil, particularly during cold, wet springs. They frequently injure planted beans, killing the plants entirely or causing light stands or a condition known as "baldhead."

Control: No direct control method is known. The flies which lay their eggs on the soil are known to be attracted by the presence of freshly decaying organic matter. In fields where potatoes are to be grown, it is best to turn under in the autumn the manure or green cover to be used as fertilizer rather than to do it in the spring before planting. Satisfactory stands and fields are obtained by replanting infested fields as soon as it is determined the first planting will be unproductive. By that time most of the maggots have developed and the second planting usually remains free of injury. Sometimes it is practicable to plant a field to beans a little earlier than the usual planting date, and then in about 10 days, rework the field and plant the main crop.

Sheep Botfly. Sheep shake their heads, stamp their feet, and crowd together, holding their noses to the ground, especially in bare dusty places; or run away with their noses held low, in

an effort to escape the fly which deposits its larvae in the nostrils of the sheep. The presence of the larvae in the nostrils causes inflammation, and a copius catarrhal discharge. The excess of mucus together with the dust drawn into the nostrils causes labored breathing. The presence of the maggots in the head may cause thinness and weakness in the animals.

Control: The bedding-out method of range sheep management followed in Idaho leave the larvae behind and is responsible for the practical absence of nose grubs in range sheep in this State. Perhaps the best method found to date for the treatment of grubs-in-the-head in farm sheep is the application of about ½ teaspoonful of a mixture of equal parts of carbon disulphide and a light mineral oil introduced into each nostril of an infested sheep. This is of decided value in killing the larvae in the sinuses of the head. The success of this method depends wholly on getting some of the solution into the infested sinuses. This can be accomplished best by laying the sheep on one side and partly turning the head over in such a way that the solution injected onto the upper surface of the nostril will run into the sinuses.

Sheep Lice. Three species of lice attack sheep; the bloodsucking louse, the bloodsucking foot louse, and the red-headed or chewing louse of sheep. The usual symptoms of scratching and biting are caused by the lice running about in the wool and over the skin. The chewing lice eat the wool fibers, the bloodsucking lice rob the sheep of nutrition and stain the wool with small brown fecal spots.

Control: These lice are best controlled on sheep by dipping the animals in nicotine, sulphur or creosote dips, giving two treatments at intervals of 2 weeks. The dilution recommended by the manufacturer of the dip should be used. The red-headed lice may be controlled by dusting sodium fluoride into the wool over the entire animal. About 1 ounce is sufficient for each sheep. Sucking lice may be controlled in winter by dusting pyrethrum or derris powders into the wool. Shallow dipping or washing of the legs in nicotine, sulphur or creosote dips should be sufficient for the foot louse, and this can be done at any season.

Sheep Tick. The sheep tick, louse, fly, or ked, as it is sometimes called, is not a true tick but an insect. It is a degenerate fly which has lost its wings. It feeds by crawling about over the wool and thrusting its sharp mouth-parts into the flesh to suck blood. It causes the sheep to rub, bite, and scratch at the wool, thus spoiling the fleece; and, when abundant, the animals are unthrifty and unprofitable. The sheep tick spends its entire life on the animal. Two stages are readily found on the sheep at all seasons of the year; the adults and the nits. The adult is brown, wingless, about ¼ inch long and is covered with short, spiny hairs. Nits are

nearly round, chestnut brown, egg-like objects that are glued to the hair especially about the neck, inside the thighs and along the belly. These are the pupal stage of the insect, not eggs.

Control: The best method of control is to dip the sheep in the fall with one of the coal-tar creosote dips according to the directions of the manufacturer. The dips do not kill the nits and the second dip must be applied to control the newly emerged adults before more nits develop.

Short-Nosed and Long-Nosed Cattle Lice. These lice are both common pests of cattle and may be considered together since their habits and control are very similar. Both of these lice are bluish gray in color. They may be found on the lower parts of the body of the cow, between the legs, on the belly, and on the escutcheon. They injure cattle by sucking blood. These lice do not migrate much on the body of the animals, but usually stay in one small area after they have found a suitable feeding place. Severe infestations cause cows to lose weight and fall off in milk production. Irritation from the lice causes the animals to attempt to rub and bite the affected parts, resulting in hair removal and, in severe cases, broken skin and scab formation.

Control: Both of these lice may be controlled by a small amount of raw linseed oil applied with a grooming brush, or by applications of sodium fluoride or rotenone dust, as previously described for the horse biting-louse. The dusts will not kill the eggs and repeated applications are sometimes necessary. The ordinary coal-tar dips also kill the lice.

Shot-Hole Borer. The shot-hole borer is sometimes found working in prune, peach, and apricot trees, especially in years following widespread frost injury to trees. During the winter this borer is in the grub or larval stage in the inner bark. The overwintering grub is about ⅛ inch long, pinkish white in color. They change to pupae in the spring and a little later the adult beetles emerge. The beetles are 1/10 inch long, half as wide, very blunt at either end, and black in color. On emerging, the beetles seek out trees in an unhealthy condition in which to lay their eggs. The bark of infested trees is perforated with numerous small "shot-hole" openings from which the insect gets its name. Beneath the bark are found many small, winding, sawdust-filled galleries that usually girdle the infested part. Death of the branch or tree follows an infestation, but beetles rarely are the primary cause of the death of a tree. This insect almost invariably confines its attacks to diseased and dying trees, or trees in a poor state of vigor.

Control: No satisfactory method of treating an infestation in a tree is known, but it is advisable to prune out all infested branches, as well as all diseased and dead wood, and burn it. Cul-

tural practices should be resorted to in order to get trees into vigorous growing condition.

Snowball Aphid. These are bluish plant lice that attack the leaves early in the spring, causing curled, deformed leaves, and small, inferior blossoms. Winter is passed in the egg stage. Newly hatched aphids attack the terminal leaves early in the spring. Injury is all caused early, for aphids fly away later and do not return to the snowball until autumn.

Control: Spray snowball bushes when the leaves first show green, using 40 per cent nicotine sulphate 1 teaspoon, commercial oil emulsion 20 teaspoons, and water 1 gallon; or spray with nicotine sulphate or pyrethrum extract, 1 teaspoon in 1 gallon of water, in which has been dissolved a piece of soap the size of a large walnut.

Snowy Tree Cricket. These green or yellowish "crickets" occur most numerously on prune trees. Eggs are deposited in the bark on the undersides of medium-sized branches in the fall. They hatch about June 1. Feeding is generally confined to the leaves until about July 25 or when the first prunes begin to show color. Crickets then attack the fruit, eating holes of various sizes into it. The first adults develop about the middle of July, after which time males may be heard chirping in unison in infested trees. There is one generation annually.

Control: Dust the trees with undiluted calcium arsenate at the rate of about 0.14 pounds per tree or spray with calcium arsenate, 2 pounds to 100 gallons of water. A spreader should be used with sprays to prevent spotting the fruit. Application should be made between July 15 and August 1. One application completely protects the fruit and so reduces the population that spraying is not necessary again for several years.

Sowbugs. These grayish, fat-bodied, fringed, slow-moving creatures attain a length of about ½ inch. They may be found near the ground under trash, leaves, or bits of manure. They cause injury by feeding on tender stems or leaves near the ground.

Control: They are controlled by means of a poisoned bait. The formula suggested on page 66 may be used, but 4 gallons of molasses per hundredweight should be added and the bait made rather sloppy. Another bait is prepared by mixing 1 part of Paris green with 9 parts of granulated sugar. This bait is sprinkled lightly along the edges of benches and walks.

Spinach Leaf Miner. White or yellowish maggots mine within the leaves of spinach, beets, chard, and many weeds, causing blasted spots or blister-like blotches. The grayish, two-winged

flies of the maggot appear in the field in April or May, and may be found throughout the season.

Control: There is no practicable method of control for this insect.

Squash Bug. Adult squash bugs are pale or dark grayish brown on the back, and the protruding margins of the abdomen are orange or alternately striped with orange and brown. The length of the body is about 5/8 inch. Eggs are whitish yellow to brown and are laid in clusters on the under sides of the leaves. The young are pink to gray and are often covered with a whitish powder. Both adults and young suck the sap and cause plants to wilt or die.

Control: The best means of reducing infestations is to burn all refuse in the fall under which the insects are hibernating. Place small strips or boards on the ground both before and after the crop is planted, and early in the morning, while the bugs are sluggish, destroy the bugs collected under the boards by dropping them into kerosene. Hand pick and destroy adults on the plants. Hand picking of nymphs and eggs is quite effective in small areas. Young nymphs may be killed by spraying them with nicotine sulphate or pyrethrum extract, 2½ teaspoons to 1 gallon of water, in which has been dissolved a piece of soap the size of a large walnut.

Stable Fly. Stable flies, to the casual observer, appear to be very much like the common house fly, but in reality they are quite different in that they feed by piercing the skin of their host to suck blood. They attack many animals, including man. They annoy the animals by their biting. This insect breeds in manure as does the common house fly.

Control: Since the flies breed in manure which is moist the control suggested is the disposal of the manure often during the fly season by distributing it on the fields where it will dry out quickly, thus preventing the adults from depositing eggs. Animals may be protected temporarily by the use of fly sprays applied to the animals themselves. Flies found about the barns may be killed with fly sprays.

Stone Fly. This species is black colored with red and yellow markings and measures between ½ inch and ¾ inch long. Larvae live in streams and emerge in the early spring leaving their cast skins on rocks and bushes. Occasionally the flies make their way to apricot and peach trees and cause severe injury by eating holes in the forming fruits and into the fruit buds.

Control: Control probably can be obtained by spraying the trees with lead arsenate as soon as the insects appear on the trees.

Strawberry Crown Moth. Adults are black, clear-winged moths varying in length from about ½ inch to ¾ inch. They are marked

diluted with gasoline and the bands dipped in this diluted material without heating. The proportions to use are 1 pound of beta naphthol, 1½ pints of 200-300 seconds viscosity oil, and 1 pint of gasoline.

Chemically treated bands 2 inches wide to be effective should contain at least 2 pounds of beta naphthol per 100 linear feet. Both oil and beta naphthol are inflammable but not explosive and beta naphthol is irritating to the eyes and skin. All work in connection with preparing chemically treated bands should be carried on out-of-doors.

Lime-Sulphur

References to lime-sulphur in this bulletin are to commercial liquid lime-sulphur only, testing 32° Baume or higher. If home-prepared liquid lime-sulphur is used it should be diluted only by hydrometer test. Use enough of the concentrate so that the dilute spray in the tank tests 4° or 5° for San Jose scale or, for blister mite alone, 3½° Baume.

Dilution Table for Lime-Sulphur

Degrees Baume	Specific Gravity	Amount of lime-sulphur solution to be used in making up 100 gallons of diluted spray.			
		For dormant spraying		For summer spraying	
		gallons	pints	gallons	pints
20	1.1600	26	7	4	4
21	1.1693	25	1	4	4
22	1.1788	24	—	4	—
23	1.1885	22	6	3	6
24	1.1983	21	6	3	4
25	1.2083	20	—	3	2
26	1.2184	18	2	3	—
27	1.2288	17	1	2	6
28*	1.2393	16	2	2	4
29	1.2500	15	3	2	4
30	1.2608	14	6	2	2
31	1.2719	14	—	2	2
32	1.2831	13	1	2	—
33**	1.2946	12	5	2	—
34	1.3063	12	—	1	6
35	1.3181	11	3	1	6

* Approximate strength of lime-sulphur made by the 50-gallon formula.
** Standard Commercial.

NOTE—Since the strengths of the solutions made according to the 50-100-50 formula and also of the commercial lime-sulphur are only approximately those indicated by the figures carrying notes (*) and (**) in column 1 above, it is suggested that the orchardist test his solution with a hydrometer, so that in making up 100 gallons of spray he can use exactly the number of gallons of lime-sulphur solution indicated in the table for a solution of that particular density.

If dry lime-sulphur is used, calculate the strength of the dilute solution on the basis of the chemical equivalent of the standard commercial liquid concentrate. The hydrometer test is not reliable in determining strength of solution of dry lime-sulphur. Five pounds of dissolved dry lime-sulphur is equivalent chemically to 1 gallon of 32° Baume liquid lime-sulphur.

Home-made Lime-sulphurs. For making the mixtures at home the following formula is in common use:

50-gallon formula:

Ground sulphur	100 pounds
Lump lime	50 pounds
Water	50 gallons

Lime-sulphur is prepared by cooking the ingredients together until practically all the free sulphur has dissolved, a process which requires approximately 45 minutes. When the spray is made in large quantities, the cooking is usually done with live steam. With smaller quantities it is more often done in kettles over a fire.

Oil Sprays

Home-prepared Emulsions. Oil emulsions may be prepared at home. With proper precautions in preparation and use, they are safe, effective, and less expensive than commercial emulsions. Stock emulsions containing the percentages of oils indicated are prepared from the following materials:

Ingredients	Amount of emulsion		
	134 gallons	10 gallons	1 gallon
Water	34 gallons	2.5 gallons	2 pints
Ammonia (28% conc.)	1 quart	2.4 fluid oz.	2 tsp.
Oil	100 gallons	7.5 gallons	6 pints
Finely powdr'd casein	3 pounds	3.6 ounces	½ ounce

When preparing the larger amounts of emulsion, put the water into the spray tank, add the ammonia, and, with the pump running, sift the casein in slowly. As soon as the casein is dissolved, add the oil about as fast as it will run from the drum. Be sure to let the oil run in slowly until the agitator is well covered, else a reversed emulsion may result. (A reversed emulsion will not mix with water and cannot be used.) Allow the mixture to be thoroughly stirred by the agitator for a few minutes then pump it through a spray hose at about 250 pounds pressure into empty drums for storage. A second pumping is advisable if the emulsion is to be kept longer than a few days.

The smaller amounts are prepared by following the same procedure as outlined above but they are pumped through the pump of a barrel sprayer or through the pump of a bucket sprayer until a uniform, creamy emulsion results. One-gallon lots of emulsion are readily prepared by the use of kitchen electric mixers. Be very careful to add the materials in the order specified.

When preparing oil emulsions by the "tank-mix" method, the amount of oil required for a tank of spray is emulsified each time the tank is filled. If 1 per cent of oil is to be used, 1 gallon of oil is emulsified or mixed in each 99 gallons of water. Procedure: First, fill the tank with water to cover the agitator and, with

agitator running, add the emulsifier. It is best to mix the emulsifier with a little water before adding it to the tank. Next, slowly pour the required amount of oil into the tank and then fill with water with the agitator running. Apply the tank-mixed spray immediately, continuing agitation until the tank is empty. A satisfactory emulsifier is a blood albumin-Fuller's earth mixture which can be purchased on the market in convenient sized packages. It is used at the rate of 4 ounces to 100 gallons of spray. The "tank-mix" method should be used only with tanks having high speed agitators or equipped with square-end agitator paddles, since a thorough agitation is necessary for a good emulsion or mixture. When lead arsenate is used, add it after the tank is filled.

Commercial Oil Emulsions. Many high grade commercial oil emulsions are on the market. Most of these contain approximately 80 per cent oil and 20 per cent water and emulsifying material. An oil emulsion is simply oil that has been mechanically broken up into tiny globules which are coated with emulsifier that prevents the globules from running together. These small coated globules are then held in suspension in the water until sprayed out and the effect thus is to dilute oil with water so that free oil, which is injurious, is not sprayed on living plants. The two general types of oil emulsions are designated in this bulletin roughly as dormant-type and summer-type. Dormant-type emulsions are prepared from lower grade oils than summer-type and are therefore cheaper. They may cause severe injury if sprayed on green foliage.

Calculating Oil Spray Dilutions. To determine the number of gallons of stock emulsion to use, multiply the number of gallons of dilute spray to be made by the percentage of oil in the stock emulsion. For example, suppose it is desired to prepare 200 gallons of dilute spray containing 3 per cent oil from a stock emulsion containing 80 per cent oil:

$$\frac{200 \times 3}{80} = 7.5\ (7\tfrac{1}{2})\ \text{gallons of stock emulsion.}$$

Precautions with Oil Sprays. Follow directions carefully. If the amount of oil is increased in proportion to the amount of water, a reversed emulsion is almost sure to occur. A reversed emulsion will not mix with water and is worthless. When through preparing the stock emulsion, each time the tank is filled, pump dilute solution through the hoses until all of the stock emulsion is cleaned out, otherwise severe damage will be done to the first tree or two sprayed. When stock emulsion is prepared in advance, stir it each time before using.

Poisoned Bran Bait

Poisoned bran bait may be prepared from either of the two following formulae:

FORMULA I

	Large amount	Small amount
Sawdust	75 pounds	7½ pounds
Millrun bran	25 pounds	2½ pounds
Liquid sodium arsenite, 4-pound material	2 quarts	52 teaspoonfuls
Water	6 to 8 gallons	3 quarts

FORMULA II

Sawdust	75 pounds	7½ pounds
Millrun bran	25 pounds	2½ pounds
White arsenic or Paris green	6 pounds	9½ ounces
Water	6 to 8 gallons	3 quarts

The bait may be mixed on a cement or wooden floor, in a tight wagon box, on a canvas, etc. The bran should be spread out thinly and the liquid added very slowly while the whole mass is being mixed. Mixing should be done very thoroughly. If *Formula I* is used, the sodium arsenite is mixed thoroughly with part of the water, then the liquid mixture, and finally the remainder of the water is added slowly to the bran and sawdust as it is being mixed with a shovel or hoe. After the necessary water has been added, reshovel the bait until it is very uniformly mixed. If *Formula II* is used, the powdered white arsenic or Paris green is first thoroughly mixed with the bran and sawdust. The water is added as in *Formula I*. The bait should be just moist enough so that when pressed in the hand it will not become lumped, and when broadcast it will break up into flakes.

Formula I is to be preferred because the liquid sodium arsenite is much more easily mixed into the bait and is less irritating to persons preparing the bait than the dry form of poison.

Preparation of Nicotine Dust

Prepared nicotine dusts are stocked by some of the insecticide dealers. Nicotine dusts deteriorate rapidly; therefore, obtain fresh stock in unbroken packages.

Nicotine dust may be prepared fresh as needed and the home-prepared is cheaper than the factory-prepared product. Procure a 10-gallon keg with both heads intact. Mount the keg on standards like a barrel churn but with the pivots in the center of the heads. Allow one pivot to protrude beyond the standard and to this fasten a crank. Cut a hole in the center of the side of the keg through which to put in and take out materials. Over the opening, hinge a lid which is held tightly in place by a clasp. Nicotine dust is made by adding nicotine sulphate containing 40 per cent nicotine to hydrated lime and mixing them thoroughly together. To make 10 pounds of nicotine dust containing a certain percentage of nicotine, multiply the number of pounds of lime by the percentage

of dust required and divide the product by 0.4. The result will be the amount of 40 per cent nicotine sulphate in pints to use. For example, suppose it is desired to make 10 pounds of 3 per cent nicotine dust:

$10 \times .03 \div 0.4 = 0.75$ (¾) pint nicotine sulphate

In mixing, place the hydrated lime in the keg, pour the nicotine sulphate over it, close the lid and rotate the mixer slowly for about 5 minutes. When placing the materials in the keg, include about 5 pounds of smooth rocks about 2 inches in diameter which help make a better mixture. Empty out the finished dust through a screen to remove the rocks and store the dust immediately in tight containers. A better type of dust may be prepared by using 2 pounds of monohydrated copper sulphate and 8 pounds of hydrated lime instead of 10 pounds of hydrated lime.

Equivalents of Measure

For preparing small amounts of spray mixtures:

1 pint equals 128 teaspoons
1 fluid ounce equals 1/16 pint or 8 teaspoons
1 ounce equals 28.35 grams
1 to 400 dilution equals 2½ teaspoons to 1 gallon

List of Insects

Alfalfa caterpillar
Eurymus eurytheme (Bdv.)

Alfalfa looper
Autographa californica (Speyer)

Alfalfa weevil
Hypera postica (Gyll.)

Angoumois grain moth
Sitotroga cerealella (Oliv.)

Apple aphid
Aphis pomi Deg.

Apple leafhoppers
Empoasca maligna (Walsh)
Typhlocyba pomaria McAtee

Asparagus beetle
Crioceris asparagi (L.)

Bark beetles
Dendroctonus brevicomis Lec.
Dendroctonus monticolae Hopk.

Bedbug
Cimex lectularius L.

Beet leafhopper
Eutettix tenellus (Bak.)

Beet webworm
Loxostege sticticalis (L.)

Birch skeletonizer
Bucculatrix canadensisella Chamb.

Black cherry aphid
Myzus cerasi (F.)

Black flies
Simulium sp.

Black peach aphid
Anuraphis persicae-niger (Smith)

Black vine weevil
Brachyrhinus sulcatus (F.)

Black widow spider
Latrodectus mactans F.

Blister beetles
Epicauta maculata (Say)
Lytta nuttalli Say
Macrobasis unicolor (Kby.)

Boxelder bug
Leptocoris trivittatus (Say)

Bronzed birch borer
Agrilus anxius Gory

Brown mite
Bryobia praetiosa Koch

Bulb mite
Rhizoglyphus hyacinthi Bdv.

Cabbage aphid
Brevicoryne brassicae (L.)

Cabbage maggot
Hylemyia brassicae (Bouche.)

Cabbage worm (imported)
Ascia rapae (L.)

Carpenter worm
Prionoxystus robiniae (Peck)

Carpet beetle
Anthrenus scrophulariae (L.)

Cattle biting-louse
Bovicola bovis (Nitz.)

Cherry fruit fly
Rhagoletis cingulata (Loew)

Chicken louse
Eomenacanthus stramineus (Nitz.)
Lipeurus heterographus Nitz.

Chicken mite
Dermanyssus gallinae (Deg.)

Chorioptic mange mite
Chorioptes communis (Gerlach)

Chrysanthemum gall midge
Diathronomyia hypogaea Loew

Clothes moth (webbing)
Tineola biselliella (Hum.)

Clover aphid
Anuraphis bakeri (Cowan)

Clover bud weevil
Hypera nigrirostris (Fabr.)

Clover leaf weevil
Hypera punctata (F.)

Clover root borer
Hylastinus obscurus (Marsham)

Clover root curculio
Sitona hispidula (F.)

Clover seed caterpillar
Grapholitha conversana Wlsm.

Clover seed chalcid
Bruchophagus gibbus (Boh.)

Clover seed midge
Dasyneura leguminicola (Lint.)

Cockroaches
Blattella germanica (L.)
Blatta orientalis L.

Codling moth
Carpocapsa pomonella L.

Colorado potato beetle
Leptinotarsa decemlineata (Say)

Common cattle grub
Hypoderma lineatum (DeVill.)

Confused flour beetle
Tribolium confusum Duv.

Corn ear worm
Heliothis obsoleta (F.)

Cottony maple scale
Pulvinaria vitis (L.)

Currant aphid
Capitophorus ribis (L.)

Currant worm (imported)
Pteronidea ribesii (Scop.)

Cutworms
Agrotis c-nigrum (L.)
Agrotis ypsilon (Rott.)
Chorizagrotis auxiliaris (Grote)
Lycophotia margaritosa Hbn.
Ufeus hulsti Sm.

Cyclamen mite
Tarsonemus pallidus Banks

Diamondback moth
Plutella maculipennis (Curt.)

Douglas fir aphid
Adelges cooleyi Gill.

Elm leaf beetle
Galerucella xanthomelaena (Schr.)

Elm leaf-curl aphid
Eriosoma ulmi (Linn.)

European earwig
Forficula auricularia L.

European elm scale
Gossyparia spuria (Mod.)

European red mite
Paratetranychus pilosus (C. & F.)

Eye-spotted bud moth
Spilonota ocellana (D. & S.)

Fall webworm
Hyphantria cunea (Drury)

False chinch bug
Nysius ericae (Schill.)

False wireworms
Eleodes extricata (Say)
Eleodes hispilabris (Say)

Firebrat
Thermobia domestica Pack.

Forest tent caterpillar
Malacosoma disstria Hbn.

Four-spotted tree cricket
Oecanthus nigricornis quadripuncatus Beut.

Fruit tree leaf roller
Cacoecia argyrospila (Walk.)

Garden slug
Limax sp.

Gladiolus thrips
Taeniothrips simplex Morison

Gooseberry fruit worm
Zophodia grossulariae (Riley)

Granary weevil
Sitophilus granarius (L.)

Grape leafhopper
Erythroneura comes (Say)

Grasshoppers
Camnula pellucida (Scudd.)
Melanoplus bivittatus Say
Melanoplus mexicanus Saussur
Melanoplus femur-rubrum (Deg.)

Greenhouse leaf tyer
Phylctaenia rubigalis (Guen.)

Greenhouse thrips
Heliothrips haemorrhoidalis (Bouche)

Greenhouse whitefly
Trialeurodes vaporariorum (Westw.)

Green peach aphid
Myzus persicae (Sulz.)

Green plant bug
Chlorochroa uhleri Stal

Hog follicle mite
Demodex phylloides Csokor

Hog louse
Haematopinus suis (L.)

Hog mange
Sarcoptes scabiei var. *suis* Gerlach

Hollyhock beetle
Calligrapha sigmoidea (Lec.)

Hop looper
Hypena humuli (Harr.)

Horse biting-louse
Trichodectes equi (L.)

Horse botfly
Gastrophilus intestinalis Deg.

Horse sucking-louse
Haematopinus asini (L.)

House fly
Musca domestica L.

Indian-meal moth
Plodia interpunctella (Hbn.)

Larder beetle
Dermestes lardarius L.

Leaf-curl plum aphid
Anuraphis helichrysi Kalt.

Legume bugs
Lygus elisus Van D.
Lygus hesperus Kngt.

Lima bean pod borer
Etiella zinckenella (Treit.)

Mealy plum aphid
Hyalopterus pruni (Geoff.)

Mediterranean flour moth
Ephestia kuehniella Zell.

Mineola moth
Mineola scitulella Hulst.

Monterey pine scale
Physokermes insignicola (Craw.)

Mormon cricket
Anabrus simplex Hald.

Mourning-cloak butterfly
Hamadryas antiopa (L.)

Narcissus bulb fly
Merodon equestris (F.)

Norway maple aphid
Periphyllus lyropictus (Kess.)

Northern cattle grub
Hypoderma bovis Deg.

Nose botfly
Gastrophilus haemorrhoidalis (L.)

Oblique-banded leaf roller
Cacoecia rosaceana (Harr.)

Onion maggot
Hylemyia antiqua Meig.

Onion thrips
Thrips tabaci Lind.

Oyster-shell scale
Lepidosaphes ulmi (L.)

Pacific mite
Tetranychus pacificus McG.

Painted lady
Cynthia cardui (L.)

Pea aphid
Illinoia pisi (Kltb.)

Pea weevil
Bruchus pisorum (L.)

Peach borer
Conopia exitiosa (Say)

Peach lecanium
Lecanium persicae (Fabr.)

Peach twig borer
Anarsia lineatella Zell.

Pear leaf blister mite
Eriophyes pyri Pgst.

Pear psylla
Psylla pyricola (Foerst.)

Pear slug
Calirora cerasi (Linn.)

Pine needle scale
Chionaspis pinifoliae (Fitch)

(Prune) leafhopper
Typhlocyba pomaria McA.

Prune-thistle aphid
Anuraphis cardui (Linn.)

Psoroptic mange mite
Psoroptes communis bovis Hering

Raspberry fruit worm
Byturus unicolor Say

Raspberry cane maggot
Pegomyia rubivora (Coq.)

Raspberry root borer
Bembecia marginata (Harr.)

Raspberry sawfly
Monophadnoides rubi (Harr.)

Red spider (common)
Tetranychus telarius L.

Rose aphid
Macrosiphum rosae (L.)

Rose curculio
Rhynchites bicolor (F.)

Rose leafhopper
Typhlocyba rosae (L.)

Rose scale
Aulacaspis rosae (Bouche)

(Rose) slug
Cladius isomerus Nort.

Rosy apple aphid
Anuraphis roseus (Baker)

Rust mite
Eriophyes oleivorus (Ashmead)

San Jose Scale
Aspidiotus perniciosus Comst.

Saw-toothed grain beetle
Oryzaephilus surinamensis (L.)

Scab mite
Psoroptes communis bovis Hering

Scaroptic mange mite
Sarcoptes scabiei suis Gerlach

Scaly leg mite
Cnemidocoptes mutans Robin

Seed-corn maggot
Hylemyia cilicrura Rond.

Sheep botfly
Oestris ovis L.

Sheep tick
Melophagus ovinus (L.)

Short-nosed and long-nosed cattle lice
Haematopinus eurysternus Nitz.
Linognathus vituli Linn.

Shot-hole borer
Scolytus rugulosus Ratz.

Snowball aphid
Aphis viburnicola Gill.

Snowy tree cricket
Oecanthus niveus (Deg.)

Squash bug
Anasa tristis (Deg.)

Stablefly
Stomoxys calcitrans (L.)

Strawberry crown moth
Synanthedon rutilans (Hy. Edw.)

Strawberry leaf roller
Ancylis comptana (Froel.)

Strawberry root weevil
Brachyrhinus ovatus (L.)

Sugar-beet root maggot
Tetanops aldrichi Hendel

Termite
Reticulitermes hesperus Banks

Throat botfly
Gastrophilus nasalis (L.)

Tomato psyllid
Paratrioza cockerelli (Sulc)

Tomato worm
Phlegethontius quinquemaculata Haw

Tree hoppers
Ceresa basalis Walk.
Ceresa stimulea (Van D.)
Heliria rubidella (Ball)
Stictocephala wickhami Fab.

(Virginia creeper) leafhopper
Erythroneura ziczac Walsh

Western black flea beetle
Phyllotreta pusilla Horn

Western potato flea beetle
Epitrix subcrinita Lec.

Wheat stem maggot
Meromyza americana Fitch

White apple leafhopper
Typhlocyba pomaria McAtee

White grubs
Polyphylla decimlineata (Say)
Ligyrus gibbosus (Deg.)

White-lined sphinx
Celerio lineata L.

Wireworms
Ludius inflatus (Say)
Limonius californicus (Mann)
Limonius canus Lec.

Wool maggots
Lucilia sericata (Meigen.)
Phormia regina Meigen.

Woolly apple aphid
Eriosoma lanigerum (Hausm.)

INDEX

ALFALFA — Page

Alfalfa caterpillar 3
Alfalfa looper 3
Alfalfa weevil 3
Beet webworm 7
Blister beetle 9
Brown mite 10
Clover bud weevil 15
Clover leaf weevil 16
Clover root borer 16
Clover root curculio 16
Clover seed chalcid 16
Cutworms 20
Grasshoppers 27
Legume bugs 35
Mormon crickets 36
Pea aphid 40
Red spider 46
Tree hoppers 57
White lined sphinx 59

APPLE

Ants 4
Apple aphid 4
Apple leafhopper 5
Brown mite 10
Cicadas 14
Codling moth 17
Cottony maple scale 19
European red mite 22
Eye-spotted bud moth 23
Fall webworm 23
Forest tent caterpillar 25
Fruit tree leaf roller 25
Legume bugs 35
Mineola moth 36
Oyster-shell scale 39
Pacific mite 39
Pear leaf blister mite 43
Red spider 46
Rosy apple aphid 47
Rust mite 48
San Jose scale 48
Shot-hole borer 52
Tree hoppers 57
Woolly apple aphid 60

APRICOT

European red mite 22
Green peach aphid 29
Mineola moth 36
Oyster shell scale 39
Peach borer 41
Peach twig borer 42
Red spider 46
San Jose scale 48
Shot-hole borer 52
Stone flies 54
Tree hoppers 57
White lined sphinx 59

ASPARAGUS

Asparagus beetle 5
Grasshoppers 27

BAIT TRAPS FOR CODLING MOTH 62

BEANS

Beet leafhopper 6
Blister beetles 9
Cutworms 20
False chinch bug 23
Grasshoppers 27
Leaf-cutter bees 34
Legume bugs 35
Lima bean pod borer 35
Red spider 46
Seedcorn maggot 50
White grubs 58
Wireworms 59

BEETS

Beet leafhopper 6
Beet webworm 7
Blister beetles 9
Cutworms 20
False chinch bug 23
Sugar beet root maggot 55
White grubs 58
Wireworms 59

BIRCH

Birch leaf skeletonizer 7
Bronzed birch borer 9

BOXELDER

Boxelder bug 9

BULBS

Bulb mite 10

CABBAGE AND RELATED VEGETABLES

Beet webworm 7
Blister beetles 9
Cabbage aphid 10
Cabbage maggot 11
Cabbage worm (imported) 11
Cutworms 20
Diamond-back moth 21
Grasshoppers 27
Western black flea beetle 58
Wireworms 59

CAT

Cat flea 24

CATTLE

Black flies 8
Cattle biting-lice 12
Cattle grubs 12
Horn fly 31
Long-nosed cattle louse 52
Scab mite 49
Short-nosed cattle louse 52
Stable fly 54

CELERY

Cutworms 20
Zebra caterpillar 61

CHEMICALLY TREATED BANDS 62

CHERRY

Black cherry aphid 8
Brown mite 10
Cherry fruit fly 13
European red mite 22
Fall webworm 23
Green peach aphid 29
Mineola moth 36
Peach borer 41
Peach twig borer 42
Pear slug 43
Red spider 46
San Jose scale 48
Shot-hole borer 52
Tree hoppers 57
White grubs 58

CHRYSANTHEMUM

Chrysanthemum gall midge 14

Grasshoppers 27
Lace bugs 33
Red spider 46

CLOVER
Alfalfa caterpillar 3
Alfalfa looper 3
Alfalfa weevil 3
Beet webworm 7
Blister beetles 9
Brown mite 10
Clover aphid 15
Clover bud weevil 15
Clover leaf weevil 16
Clover root borer 16
Clover root curculio 16
Clover seed caterpillar 16
Clover seed chalcid 16
Clover seed midge 17
Cutworms 20
Grasshoppers 27
Legume bugs 35
Pea aphid 40
Red spider 46
Tree hoppers 57

CONIFEROUS TREES AND SHRUBS
Bark beetles 6
Douglas fir aphid 21
Forest tent caterpillar 25
Monterey pine scale 36
Pine needle scale 44
Red Spider 46

CORN
Alfalfa looper 3
Blister beetles 9
Corn ear worm 19
Cutworms 20
False chinch bug 23
Grasshoppers 27
Seedcorn maggot 50
Western black flea beetle 58
White grubs 58
Wireworms 59

COTTONWOOD
Bronzed birch borer 9
Carpenter worm 11

CURRANT
Apple leafhopper 5
Cottony maple scale 19
Currant aphid 19
Gooseberry fruit worm 26
(Imported) currant worm 19
Oyster-shell scale 39
Red spider 46
San Jose scale 48

DELPHINIUM
Black vine weevil 8

DOG
Dog flea 24

ELM
Carpenter worm 11
Elm leaf beetle 21
Elm leaf curl aphid 21
European elm scale 22
Fall webworm 23
Mourning-cloak butterfly 37
Red spider 46
Woolly apple aphid 50

FIELD AND FORAGE CROPS
Cutworms 20
Grasshoppers 27
Mormon cricket 36
Wheat stem maggot 58
White grubs 58
Wireworms 59

GLADIOLUS
Bulb mite 10
Thrips 26

GOOSEBERRY
Apple leafhopper 5
Cottony maple scale 19
Currant aphid 19
Currant worm (imported) 19
Gooseberry fruit worm 26
Red spider 46
San Jose scale 48

GRAPE
Cottony maple scale 19
Four-spotted tree cricket 25
Grape leafhopper 27
Grasshoppers 27
Oyster-shell scale 39
Pacific mite 39
San Jose scale 48
Virginia creeper leafhopper 57

GREENHOUSE PESTS
Ants 4
Centipedes 12
Garden slug 26
Greenhouse leaf tyer 28
Greenhouse thrips 28
Greenhouse whitefly 29
Mealybugs 35
Oblique-banded leaf roller 38
Red spider 46
Sowbugs 53

HOGS
Follicle mites 25
Hog louse 30
Hog mange 30

HOLLYHOCK
Hollyhock aphid 30
Hollyhock beetle 30

HOPS
Hop looper 30
Red spider 46

HORSE
Black flies 8
Chorioptic mange 14
Horse biting-lice 31
Horse botfly 32
Horse flies 32
Horse sucking-lice 33
Nose botfly 38
Psoroptic mange mite 44
Scaroptic mange mite 49
Stable fly 54
Throat botfly 56

HOUSEHOLD AND STORAGE INSECTS
Angoumois grain moth 4
Ants 4
Bedbug 6
Black widow spider 8
Boxelder bug 9
Brown mite 10
Carpet beetles 11
Clothes moths 14
Cockroaches 17
Confused flour beetle 18
European earwig 22
Firebrat 24
Fleas 24
Granary weevil 27
Greenhouse whitefly 29
House fly 33

Indian-meal moth 33
Larder beetle 34
Mealybugs 35
Mediterranean flour moth 36
Saw-toothed grain beetle 48
Sowbugs 53
Termites 56

LETTUCE
Alfalfa looper 3
Cabbage worm 11
Cutworms 20
Garden slug 26
Grasshoppers 27
Wireworms 59

LILAC
Bulb mite 10
Leaf cutter bees 34

LIME-SULPHUR 63

MAPLE
Boxelder bug 9
Carpenter worm 11
Cottony maple scale 19
Fall webworm 23
Norway maple aphid 38

MOUNTAIN ASH
Forest tent caterpillar 25
Oyster-shell scale 39
Pear leaf blister mite 43
Rosy apple aphid 47
Woolly apple aphid 60

NARCISSUS
Bulb mite 10
Narcissus bulb fly 37

NICOTINE DUST 66

OIL SPRAYS 64

ONION
Blister beetles 9
Cutworms 20
Grasshoppers 27
Onion maggot 38
Onion thrips 39
Webworms 7
Wireworms 59

ORNAMENTAL FLOWERS AND SHRUBS
Beet leafhopper 6
Blister beetles 9
Bulb mite 10
Cabbage worm 11
Carpenter worm 11
Cottony maple scale 19
Cyclamen mite 20
Diamond-back moth 21
European earwig 22
Fall webworm 23
Forest tent caterpillar 25
Gladiolus thrips 26
Grasshoppers 27
Lacebugs 33
Leaf cutter bees 34
Legume bugs 35
Mormon cricket 36
Mourning cloak butterfly 37
Narcissus bulb fly 37
Norway maple aphid 38
Oblique-banded leaf roller 38
Oyster-shell scale 39
Pacific mite 39
Painted lady 40
Pear slug 43
Red spider 46
San Jose scale 48
Shot-hole borer 52
Tree hoppers 57
White grubs 58

PEA
Blister beetles 9
Cutworms 20
Grasshoppers 27
Lima bean pod borer 35
Pea aphid 40
Pea weevil 41
Red spider 46
Seedcorn maggot 50
Wireworms 59

PEACH
Black peach aphid 8
Brown mite 10
Cottony maple scale 19
European red mite 22
Eye-spotted bud moth 23
Fall webworm 23
Fruit tree leaf roller 25
Green peach aphid 29
Legume bugs 35
Pacific mite 39
Peach borer 41
Peach lecanium 42
Peach twig borer 42
Red spider 46
San Jose scale 48
Shot-hole borer 52
Stone flies 54
Tree hoppers 57

PEAR
Apple aphid 4
Brown mite 10
Cherry fruit fly 13
Cicadas 14
Codling moth 17
Cottony maple scale 19
European red mite 22
Fall webworm 23
Fruit tree leaf roller 25
Leaf cutter bees 34
Legume bugs 35
Oyster-shell scale 39
Pacific mite 39
Pear leaf blister mite 43
Pear psylla 43
Pear slug 43
Red spider 46
Rosy apple aphid 47
San Jose scale 48
Tree hoppers 57
Woolly apple aphid 60

PHLOX
Red spider 46

PINE, See coniferous trees

PLUM, See prune

POISONED BRAN BAIT 66

POTATO
Blister beetles 9
Colorado potato beetle 18
False chinch bug 23
Legume bugs 35
Red spider 46
Seedcorn maggot 50
Tomato psyllid 56
Tomato worm 57
Western potato flea beetle 58
White grubs 58
Wireworms 59

POULTRY
Bedbugs 6
Chicken lice 13

Chicken mite 13
Scaly leg mite 49

PRUNE
Brown mite 10
Cottony maple scale 19
European red mite 22
Fruit tree leaf roller 25
Green peach aphid 29
Leaf-curl plum aphid 34
Mealy plum aphid 35
Mineola moth 36
Oyster-shell scale 39
Peach borer 41
Peach twig borer 42
Pear slug 43
Prune leafhopper 44
Prune-thistle aphid 44
Red spider 46
San Jose scale 40
Shot-hole borer 52
Snowy tree cricket 53
Tree hoppers 57

RADISH, See cabbage

RASPBERRY
Apple leafhopper 5
Brown mite 10
False chinch bug 23
Four-spotted tree cricket 25
Grasshoppers 27
Legume bugs 35
Raspberry cane maggot 45
Raspberry fruit worm 45
Raspberry root borer 45
Raspberry sawfly 46
Red spider 46
Rose scale 47
San Jose scale 48
Strawberry leaf roller 55
Strawberry root weevil 55

ROSE
Apple leafhoppers 5
Leaf cutter bees 34
Red spider 46
Rose aphid 46
Rose curculio 47
Rose leafhopper 47
Rose scale 47
Rose slugs 47
San Jose scale 48

SHEEP
Black flies 8
Scab mite 49
Sheep botfly 50
Sheep lice 51
Sheep tick 51
Stable fly 54
Wool maggots 60

SNOWBALL
Snowball aphid 53

SPINACH
Blister beetles 9
Cutworms 20
Spinach leaf miner 53
Wireworms 59

SPRUCE, See coniferous trees

SQUASH
Beet leafhopper 6
Cutworms 20
Squash bug 54
Wireworms 59

STORAGE INSECTS, See household insects

STRAWBERRY
Ants 4
Black vine weevil 8
Cutworms 20
Cyclamen mite 20
False chinch bug 23
Garden slug 26
Grasshoppers 27
Leather jackets 34
Legume bugs 35
Red spider 46
Strawberry crown moth 54
Strawberry leaf roller 55
Strawberry root weevil 55
White grubs 58
Wireworms 59

SWEET PEA
Cutworms 20
Grasshoppers 27
Pea aphid 40
Red spider 46
Thrips (See control for onion thrips) 39

SUGAR BEET
Sugar beet root maggot 55
Western black flea beetle 58
White grubs 58

TOMATO
Beet leafhopper 6
Blister beetles 9
Colorado potato beetle 18
Corn ear worm 19
Cutworms 20
Grasshoppers 27
Tomato psyllid 56
Tomato worm 57
Western potato flea beetle 58

TURNIP, See cabbage

VEGETABLES
Ants 4
Beet leafhopper 6
Beet webworm 7
Blister beetles 9
Cabbage maggot 11
Cabbage worm 11
Centipedes 12
Corn ear worm 19
Cutworms 20
European earwig 22
False chinch bug 23
Garden slug 26
Grasshoppers 27
Greenhouse leaf tyer 28
Leather jackets 34
Legume bugs 35
Mormon cricket 36
Onion thrips 39
Painted lady 40
Red spider 46
Seed corn maggot 50
Squash bug 54
Webworms 7
Western black flea beetle 58
Western potato flea beetle 58
White grubs 58
Wireworms 59

VIRGINIA CREEPER
Cottony maple scale 19
Leaf cutter bees 34
Red spider 46
Virginia creeper leafhopper 57

WATERMELON
Beet leafhopper 6
Cutworms 20
Grasshoppers 27

Squash bug 54
White grubs 58

WHEAT

Alfalfa looper 3
Cutworms 20
False chinch bug 23
False wireworms 24
Grasshoppers 27
Green plant bug 29
Mormon cricket 36
Wheat stem maggot 58
White lined sphinx 59
Wireworms 59

WILLOW

Bronzed birch borer 9
Carpenter worm 11
Mourning cloak butterfly 37
Oyster-shell scale 39
San Jose scale 48
Tree hoppers 57